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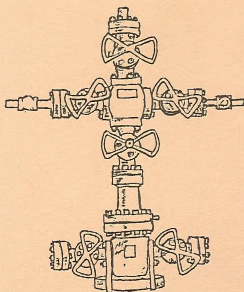
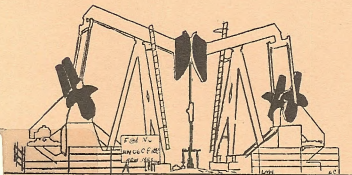
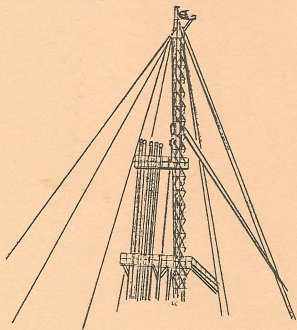
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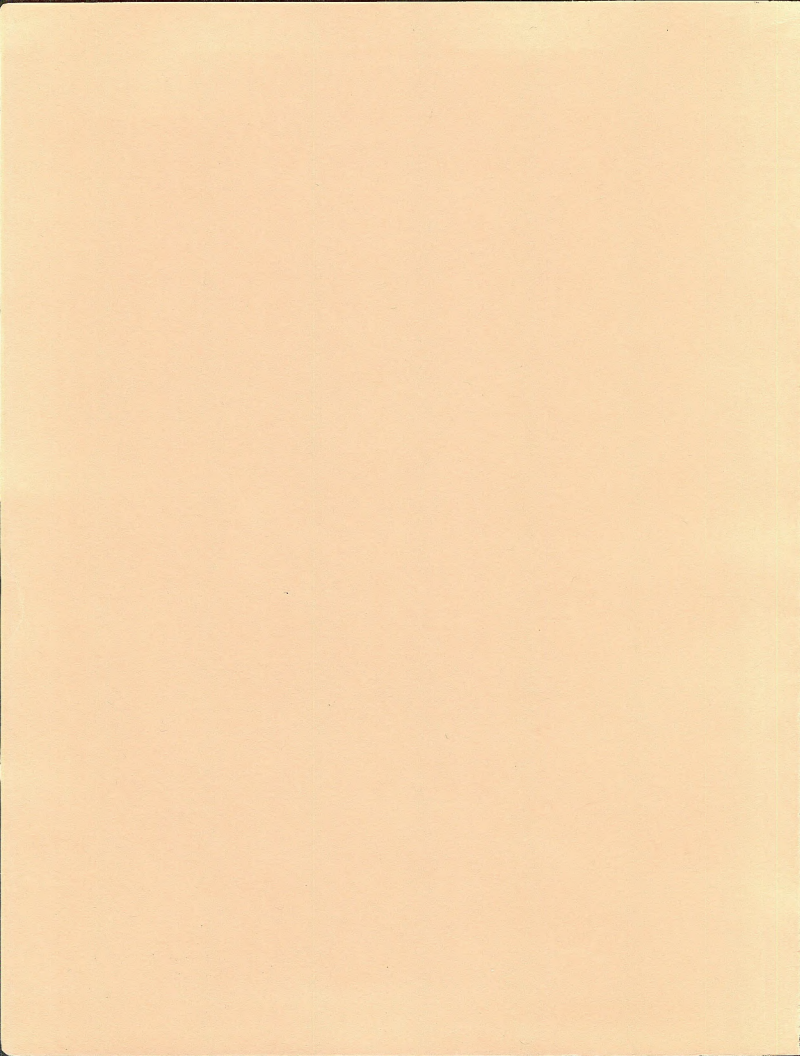
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OIL AND GAS LEASING



ROSWELL DISTRICT
SOUTHEASTERN
NEW MEXICO
July 1981





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FINAL

ENVIRONMENTAL ASSESSMENT

OIL AND GAS LEASING
IN THE ROSWELL DISTRICT, BLM

Roswell District Office, BLM

1981

Approved by:

Richard W. Bastin
Richard W. Bastin, Acting District Manager

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CHAPTER 1
PROPOSED ACTION
AND
ALTERNATIVES

Chapter 1

DESCRIPTION OF THE PROPOSED ACTION

I. PURPOSE AND NEED

This environmental Assessment (EA) updates Environmental Analysis Record (EAR) No. 30-060-4-49, dated May 4, 1974. The current assessment also identifies environmental and socioeconomic impacts which are associated with exploration for and production of oil and gas in the Bureau of Land Management's (BLM's) Roswell District. Methods and procedures for minimizing any adverse impacts which would also result, are also considered.

This revision will be used as a tool to assist in carrying out Bureau responsibilities regarding oil and gas leases and related operations. These include those responsibilities which have been delegated by Secretarial Order 2948 involving the processing of lease and drilling applications, notices to conduct exploration and to abandon wells, and various other permits and rights-of-way, together with other laws and regulations (see Authorizing Actions).

This document is structured to be a management tool as well as being an assessment of impacts. It will be used as a reference for site-specific actions to expedite processing of applications which are related to oil and gas activities, while providing for adequate conservation of resources and for mitigation of impacts to the environment.

II. INTRODUCTION AND BACKGROUND

Oil was first discovered in New Mexico in 1909 at Dayton, a small community eight miles south of Artesia (Helmig, 1956), but the well was soon abandoned because of an inability to separate water from the oil. By 1924, technology had improved and the first commercial oil discovery in southeastern New Mexico was made, also in the vicinity of Artesia. In 1927, Lea County, now New Mexico's major producer of oil and gas, had its first successful well completion.

In 1932, the annual market value of New Mexico's oil and gas production was \$10 million. This figure had more than tripled to \$33.6 million by 1942, rising to \$161.7 million in 1952. Current (1980) values are in excess of \$2,681,185,000 (New Mexico Progress, 1979 Economic Report, Vol. 47).

Today, New Mexico ranks fourth in the national production of natural gas and fifth in petroleum products. The New Mexico Oil Conservation Commission (OCC) reports that 92 percent of the state's petroleum and 51 percent of the natural gas production is extracted from that portion of the Permian Basin which is located in southeastern New Mexico. The

Roswell District, U. S. Bureau of Land Management (BLM), lies on the western edge of the Permian Basin. Both Eddy and Lea counties, plus most of Roosevelt and Chaves counties lie within this basin and contain the district's most productive oil and gas fields.

The Roswell District administers the public lands and minerals in New Mexico's Chaves, Eddy, Lea, Roosevelt, Guadalupe, Lincoln, Curry, DeBaca, and Quay counties. In addition, this district also administers all federally-owned mineral resources in Texas. This assessment deals only with those federal lands which are located in New Mexico. Impacts are considered as applying to Texas only to the extent that those impacts and the environment normally encountered are similar.

This environmental assessment also encompasses National Forest lands administered by the U. S. Forest Service but only covers these lands in a general fashion. For more specific information, see specific area assessments which are written by the Forest Service.

In these Forest Service areas, the Bureau of Land Management (BLM) is responsible for issuing leases for the exploitation of federal minerals. When a lease is proposed on lands administered by the USFS, BLM requests recommendations from that agency for the protection of surface resources. At the present time the USFS has prepared area environmental assessments which address expected leasing impacts in portions of the Lincoln National Forest. Area assessments only encompass lands where leasing activity has occurred or is anticipated to take place. Individual lease applications are evaluated within the context of area assessments and may be addressed in an amendment to the more general assessment. Mitigation measures identified in the area assessment and amendment are then transmitted to BLM as recommended stipulations for any lease which may ensue. In the majority of cases BLM accepts the other agencies' surface protection recommendations, which are made a condition of the lease offer.

In the first quarter of 1980, the BLM issued over 600 leases covering 1.5 million acres in the Roswell District, with an average of 200 being issued and/or renewed each year. In 1979, there were 19,000 producing oil and gas wells in the district with about one-third being located on federal lands. Approximately 30 percent of the petroleum and gas production in southeastern New Mexico during 1979 was extracted from federal mineral holdings managed by BLM's Roswell District. For some counties within this district, oil and gas production from federal leases runs as high as 75 percent. Also, in addition to oil and gas, small quantities of carbon dioxide (CO₂), sodium brine and lithium brine production are expected to begin in the Roswell District. Activities involved in such production are similar to those required for oil and gas production and, therefore, are included in the proposed action.

III. DESCRIPTION OF THE PROPOSED ACTION AND IT'S ALTERNATIVES

A. Proposed Action

The proposed action is to continue to authorize leasing and exploration for oil, gas, sodium and lithium brine, and carbon dioxide (CO₂) resources on public and reserved mineral lands within the Roswell District and to promote both leasing and production of these resources. This action would also authorize abandonment of leases upon compliance with BLM and U. S. Geologic Survey (USGS) stipulations and regulations. All leases are issued by the BLM State Office in Santa Fe, after consultation with the District Office, under the authority of the Mineral Leasing Act of February 25, 1920, as amended (44 Stat. 437; 30 U.S.C. 181 et. seq.) and the Mineral Leasing Act for Acquired Land of August 7, 1947 (61 Stat. 193; 30 U.S.C. 351-359). Regulations implementing these lease actions are contained in Title 43, Code of Federal Regulations (CFR), Subparts 3100 (oil, gas, and CO₂) and 3500 (sodium and lithium) as well as Title 30, CFR, Subparts 221 and 231. These actions are also controlled by USGS' Notice to Lessees (NTL) 6 (See Appendix B).

1. Oil and Gas Procedures Under the Proposed Action

a. Geophysical Exploration (43 CFR 3045)

In areas where detailed geologic information is lacking, exploration crews and their equipment may need to be physically present upon the land. Specially constructed off-road vehicles are normally used to gain access to the desired location, with surface disturbances being limited to the vehicle track and to holes which may be drilled for geochemical sampling or seismic shots.

Exploration crews must file a Notice of Intent with the BLM District Manager before entry on any public lands not held by the lessee and a Notice of Completion upon cessation of activity. These requirements do not apply to a lessee or authorized contractor conducting exploratory work for the lessee on an existing lease.

b. Leasing (43 CFR 3100)

Oil and gas leases are offered simultaneously, noncompetitively, or competitively. Simultaneous offers are lands which are not within a known geologic structure (KGS) which had been previously leased and have expired, been relinquished, or terminated. These leases are then awarded through a lottery-type system. Noncompetitive applications (also known as "over the counter leases") are filed on areas which have not been leased before and are applied for directly. Competitive leases are offered for known producing areas (known geologic structures).

Potential leaseholders bid, with the highest bidder being awarded the new lease.

The BLM District Office is responsible for determining the presence of any sensitive environmental resources which may exist in an area being considered for leasing. Standard operating procedures are incorporated into appropriate stipulations or schedules as part of each oil and gas lease. Appropriate special stipulations, in addition to standard operating procedures, would be formulated to protect sensitive resources and incorporated as a condition to granting of a lease as provided for on Form 3109, Surface Disturbance Stipulations. To ensure that threatened or endangered (T/E) plant or animal species are properly protected, site-specific studies will be made as leases are developed and individual requests for formal Section 7 consultations with the U. S. Fish and Wildlife Service (USFWS) will be initiated as necessary.

c. Drilling Permits (30 CFR 221; NTL-6)

An application for a permit to drill (an APD), is filed with the USGS by the lessee or designated operator. This APD must be accompanied by a surface use plan (SUP). A copy of the surface use plan is supplied to the BLM. Both agencies then review the location for potential conflicts with other resource values. If conflicts are noted, a field inspection with representatives of both agencies and construction personnel, together with the operator and/or lessee, may be scheduled to resolve problem areas. If a location is found which is acceptable to all concerned parties, the BLM will concur with the surface use plan and notify the USGS. The USGS then assesses potential environmental impacts prior to authorizing the proposed action. However, the USGS does not authorize well locations without BLM concurrence.

Construction of access roads and drilling pads normally disturbs the surface of areas involved. A well location normally disturbs a surface area of from 0.7 to 3.7 acres, depending upon the drilling rig used and well depth. Generally, the location must be leveled and, depending on topography, may involve substantial cut-and-fill activities. Normally, the disturbed area is then utilized for a drilling pad and ancillary facilities.

d. Development (30 CFR 221; NTL-6)

Following the discovery of a new oil and gas field, subsequent wells may be drilled until the reservoir limits are established, often joining numerous leases into unitized oil and/or gas fields. The procedure followed is the same as that for initial exploratory drilling. Often additional access roads and well pads are required and must be authorized by the U. S. Geologic Survey with BLM's concurrence.

e. Production (30 CFR; NTL-6)

Production begins when the oil, gas, CO₂, or sodium-lithium resources can be marketed, whether by pipeline or by truck. In the Roswell District, the majority of surface disturbances take place in the production phase, with new wells being drilled periodically to bring new areas of an active field into production. A continuing study is made of a reservoir during its productive life to obtain data which can be used by the operator to recover additional volumes of oil and to help in selecting the optimum time for initiation of secondary recovery efforts.

Facilities which will be located on the surface are dependant on several factors, such as whether oil and/or gas is being produced and in what volume, the phase (initial or secondary), and/or depth of production, and the mixture of fluids being produced. Such facilities may consist of one or more of the following: (1) a well head, (2) pumping equipment, (3) a separation system, (4) pipelines, (5) a metering system, (6) storage facilities, (7) water treatment and injection facilities, (8) cathodic protection systems, (9) electrical distribution lines, (10) compressor stations, (11) communication sites, (12) roads, (13) salt water disposal systems, (14) dehydration sites, and (15) fresh and salt water plant sites.

f. Abandonment (30 CFR; NTL-6)

Wells are sometimes shut in because pipelines, roads, etc., necessary for their production and marketing are not available. In such cases, these wells may be reentered when their production can be marketed. The permanent abandonment phase begins near the end of the reservoir production phase, or when a test proves that the well will be unprofitable. When the flow from a well reaches the point where production is no longer profitable, or the well cannot be used for other purposes, the operator requests permission from the USGS to plug and abandon it. The operator must submit an abandonment plan and outline his proposed procedures. Abandonment plans, in addition to protecting subsurface resources must provide for disturbed soils and other resources to be restored and/or rehabilitated as provided for in the lease stipulations. The BLM is contacted for recommendations as to the necessary surface restoration methods and works through USGS with the operator to assure proper compliance with abandonment stipulations. The USGS is responsible for final approval of actions for abandonment of wells and for overall operations. In some cases, the gathering system's underground pipelines could be left in place since the cost of removal often exceeds the salvage value and would unnecessarily disturb the environment.

After the lease has been relinquished, terminated or has expired, the Bureau of Land Management (BLM) must prepare a report either accepting the surface rehabilitation as adequate, or rejecting it.

If rehabilitation is rejected, any problems or deficiencies must be defined. A lease bond is terminated by the USGS only upon BLM's recommendation when the Bureau is satisfied with the lessee's compliance with lease stipulations.

B. Alternatives to the Proposed Action

1. No Action

If this alternative were to be adopted, new leases would not be issued in the Roswell District. However, the Bureau of Land Management is required by law (Mineral Leasing Act of 1920, as amended), regulation (30 CFR 0045-3100), and policy to lease minerals unless the proposed lease would not be in the public interest because it would be incompatible with current uses or other values which are worthy of being preserved. Decisions to deny lease applications may be made on a case-by-case basis only. Because this is a district-wide environmental assessment, this alternative is not feasible and will not be discussed further.

C. Current And Proposed Standard Operating Procedures

Consultations and efforts to assure that effective coordination and cooperation exist between the U. S. Geological Survey (USGS), other federal and state agencies, the petroleum industry, and the public in developing the BLM's planning system have resulted in the creation of numerous standard operating procedures. These are published in the original Oil and Gas Environmental Assessment, printed in 1974.

These procedures were developed to mitigate known and expected impacts to the environment and to other ongoing and/or potential uses of the public lands. These procedures are divided into two categories: (1) Current standard operating procedures, and (2) Proposed standard operating procedures, and are included in this document as Appendix A. All standard operating procedures (issued as schedules or stipulations) must have the concurrence of the U. S. Geological Survey (USGS) because that agency is responsible for compliance by the lessee and for enforcement. Current standard operating procedures have been approved by the U. S. Geological Survey. The proposed procedures are the result of decisions which have been developed through the BLM's planning system's Management Framework Plan (MFP), which have not yet received USGS concurrence. Certain "open ended" stipulations are included on Form 3109-5, Surface Disturbance Stipulations (see Appendix A). This form provides for site-specific environmental assessments for applications to drill (APDs) and for site-specific surveys to ascertain the presence of threatened or endangered (T&E) animal or plant species.

D. Monitoring

Oil and gas activities which would take place under implementation of the proposed action and/or its alternatives, would be monitored to assist decisionmakers in gathering and evaluating the effects of the actions chosen. Such information would also be necessary in the event that modification or termination of any approved activities became necessary. Data would also be available to study the effects of mitigating

actions taken by the lessee or the appropriate federal agencies, and be used in assuring that future actions utilize any new information gained.

The six goals of monitoring are:

1. To determine if the action is fulfilling the purpose and need for which it was developed.
2. To determine if impact predictions are accurate.
3. To discover unanticipated and/or unpredictable effects.
4. To determine if mitigation measures are working as prescribed.
5. To assist in resolving differences of opinion regarding impacts.
6. To assure that decisions are being implemented.

E. Authorizing Actions

There are many federal laws and regulations involved in oil and gas operations as well as in the development of environmental documents. These include:

1. Federal Land Policy and Management Act of October 21 1976 (PL 94-579; 90 Stat 2743; 43 USC 1701).
2. Taylor Grazing Act of 1934 (43 USC 315).
3. Mineral Leasing Act of February 28, 1920 (30 USC 181 et. seq., as amended and supplemented).
4. Mineral Leasing Act for Acquired Lands of August 7, 1947 (61 Stat 913; 30 USC 351-359).
5. Antiquities Act of 1906 (PL59-209; 34 Stat 225; 16 USC 432, 433).
6. Historic Sites Act of 1935 (PL74-292; 49 Stat 666; 16 USC 461, et. seq.).
7. National Historic Preservation Act of October 15, 1966 (PL 89-665; 80 Stat 915; 16 USC 470) As Amended (PL 94-422; 90 Stat 1313; and PL 94-458; 90 Stat 1939).

8. Archeological Resources Protection Act of 1979 (PL 96-95; 16 USC 470).
9. National Environmental Policy Act of 1969 (PL 91-100; 83 Stat 852; 43 USC 432).
10. Council on Environmental Quality Guideline (40CFR, Part 1500).
11. Endangered Species Act of 1973 (16 USC 668).

CHAPTER 2

AFFECTED ENVIRONMENT



Chapter 2

DESCRIPTION OF THE AFFECTED ENVIRONMENT

The following sections describe components of the Roswell District's environment, however, only those items which are most likely to be impacted by the continuation of oil and gas-related activities will be given descriptive emphasis.

A. Non-Living Components

1. Topography

Topographical features of the Roswell District consist primarily of broad, high plains to the east which are widely dissected in the extreme northeastern areas, the Pecos River Valley in the center, and mountainous terrain to the west. Elevations vary from a high of over 12,000 feet in the Sacramento Mountains, to a low of 2,800 feet in the southern valley of the Pecos River. Most topographic trends are north to south.

2. Geology

Most rocks found in the Roswell District of the BLM are clastic, carbonate, and evaporitic sedimentary deposits of late Paleozoic, Mesozoic, and Cenozoic Ages. Some intrusive Tertiary igneous rocks are found in southeastern New Mexico, with their frequency increasing toward the mountain areas on the district's western edge. Precambrian crystalline rocks, as well as Tertiary volcanics and Quaternary lava flows, are confined to western Lincoln County.

In general, surface sediments within the Pecos River Valley are Quaternary Age clastic fluvial deposits and are underlain by terrestrial Mesozoic sediments to the north and by Permian marine deposits to the south. To the east, the surface is composed of Quaternary alluvial and bolson deposits and Tertiary gravels of the Ogallala Formation. To the west, alluvial deposits give way to Permian limestone on the Pecos slope, followed by uplifted Paleozoic and Mesozoic sediments intruded by Tertiary igneous rocks in the Sacramento and Capitan Mountains.

3. Paleontology

Paleontologic resources preserved in marine and terrestrial sediments may be found in rocks formed during the late Paleozoic, Mesozoic, and Cenozoic Ages. Detailed data concerning Pennsylvanian and Permian Age fossils (restricted to invertebrates) is available because of the intense oil and gas exploration in southeastern New Mexico where

such data is necessary for stratigraphic correlation (age dating) of producing formations. Such information is lacking in nonproducing areas in the northern and western portions of the Roswell District. Little has been reported concerning Mesozoic Age fossils, except for the shells and shark's teeth associated with the Purgatoire Formation in Quay and Guadalupe Counties. The Morrison Formation, famous for its well-preserved vertebrate faunas in other areas, also occurs in Quay and Guadalupe Counties but has not been well explored.

The paleontologic remains found in some isolated Cenozoic terrestrial sediments are perhaps the best known and most scientifically interesting vertebrate fossils found in the Roswell District. These Pleistocene-Holocene fossils are usually associated with lake deposits, caves, or early man's hunting sites. In addition to these isolated finds, the Ogallala Formation possesses the potential for fossil preservation in low energy environment areas, although none are identified in the available literature.

The extent of known paleontologic resources in the district is small, compared to the amount of sedimentary rocks which may contain fossil remains. In addition, little is known concerning the relative scientific value of those resources which have been identified.

4. Land Use, Minerals

Petroleum has been produced from late Paleozoic Age rocks in the Delaware Basin of southeastern New Mexico since 1924. Most of the gas production has been from sandstones of the lower Pennsylvanian Strata, while most of the crude oil comes from the middle and late Pennsylvanian and Permian carbonates. Massive beds of halite (sodium chloride) occur in the Rustler, Salado, and Castile Formations, with potash salts being produced from the Salado Formation in the Carlsbad area. Sulphur is known to occur in Permian evaporites and exploration for commercial deposits has begun just north of the Texas border near White City. Small coal seams are found in Cretaceous sediments in Western Lincoln County and have been mined as a local fuel source.

Metallic deposits are generally small and of poor quality. Claims for uranium, thorium, copper, gold, silver, iron, manganese, fluorite, and other minerals have been recorded over the years in many parts of this district but the only major mining district on or near BLM-administered land is in the White Oaks area of Lincoln County. Mining has ceased in that area and most important finds have been patented.

Mineral materials, especially caliche and both sand and gravel, are mined throughout this district. Most activity is confined to providing materials which will surface roads and drilling pads for oil and gas development.

5. Soils

Differences in climate, parent materials, soil textures, slope, and soil depth are the main characteristics which cause the soil types to vary greatly throughout this area. These variations are the primary reasons that susceptibility to erosion differs so greatly. Water runoff tends to erode soils on the steeper slopes more quickly than it does those on the more level landscapes. Sandy soils tend to be more affected by the wind than do other soil types. High concentrations of carbonatics in the area increase the susceptibility of soils to erosion.

Generally, the Roswell District's western areas have shallow, rocky soils with limestone bedrock being located within 20 inches of the soil surface. These soils occur on rolling hills. Due to these rocky surfaces, erosion hazards of these soils are low. Deep, loamy soils which have moderate water erosion hazards, occur in the draws and drainages below the hills and are associated with these shallow soils. The district's central portion is strongly influenced by the Pecos River. Soils along the river valley are mostly level and are usually deep, with varied textures. High concentrations of calcium carbonates (caliche) occur in the substratum. These soils are highly susceptible to wind erosion, but only moderately to erosion by water. Soils which occur along the floodplains are the most varied in texture. These soils were formed in depositions by the river and have textures which range from sand to clay. Carbonates and gypsum concentrations are common in the substrata and since textures and parent materials differ greatly, the erosion hazards of these soils range from low to high.

East of the Pecos River, soils are also quite varied in texture and depths. Most have carbonate accumulations in their profiles with some of these accumulations forming hard caliche layers which cause shallow, restrictive layers. These soils have moderate erosion hazards. Some soils near the Pecos River Valley were derived from gypsum parent materials and can be eroded easily by both wind and water. Deep sandy soils are also found throughout the eastern side of the river, occurring as billowy sand hummocks or as large dunes formed by blowing and deposition of these soils. If these sandy soils are not protected by vegetative cover, the wind erodes them quickly.

Because of the wide-ranging varieties of soil types in this district and the many variations in vegetative type caused by inconsistent distribution of soil types, rehabilitation of disturbed soils would be quite complex. Soils determine which vegetative species will adapt to each specific site.

6. Air Quality

In general, air quality in the Roswell District is good. Summer winds flow from the southeast, becoming southwesterly in the winter and early spring. Winds in the Carlsbad area are typical, averaging 10 miles per hour (mph) in the fall and 16 mph in the spring. Peak velocities reach 50 mph. This combination gives southeastern New Mexico some of the best conditions in the nation for rapid dispersal of pollutants.

There are occasional winter inversions which can best be seen by observing the emission plume patterns of potash mines in east Eddy and Lea Counties. However, these inversions are of short duration because of storm fronts and of unstable cold air masses moving through the area. Summer inversions last longer and convection columns can occur at any time and place, particularly in the summer when solar radiation destabilizes the air close to the ground, producing air turbulence.

Wind action on exposed or disturbed soils is the primary source of air pollution in this area. These soil particles create dust storms of various magnitudes, depending on wind velocity. Mining and both oil and gas operations contribute to some degree of air pollution, with air quality being affected by emissions produced by the potash mines located southeast of Carlsbad. These emissions are particles of potassium chloride, potassium oxide, silicon dioxide, and water vapor. The use of hydrocarbons in the various phases of oil and gas production, plus the burning of oil field wastes contribute to air pollution.

Noise pollution is created by the use of heavy equipment and the operation of various kinds of machinery in both the oil and gas and the potash mining industries.

7. Water Resources

There are four major water basins in the Roswell District (map 1). These are the:

- a. Pecos River Basin
- b. Texas Gulf Basin
- c. Arkansas-White-Red River Basin
- d. Rio Grande Basin

Two of these, the Arkansas-White-Red River Basin and the Rio Grande Basin, will not be discussed as they are not currently involved in oil and gas activity.

a. Pecos River Basin

This basin has an area of 25,922 square miles and extends from northcentral New Mexico's Sangre de Cristo Mountains, south to the Texas state line, a distance of about 435 miles. Major tributaries of the Pecos River in New Mexico are the Gallinas River, Salt Creek, Rio Hondo, Rio Felix, Rio Penasco, Seven Rivers, Rocky Arroyo, Dark Canyon, Black River, and Delaware River. Surface flow is erratic and is influenced by locally heavy rains. According to gaging stations, more than 70 percent of the annual runoff occurs between April and August. This is also the period of highest thunderstorm activity.

The average seasonal distribution of streamflow at ten gaging stations in this basin, derived for a 10-year period (1956-65) is presented in Table 1 (New Mexico Water Resources, November 1976). The usable average annual surface water supply in New Mexico's Pecos River is estimated to be 205,000 acre feet.

[illegible]

GENERAL MAP

2-6

Table 1
Annual Discharge, 1956-65
(1,000 acre-feet)

(Source: New Mexico Water Resources, Assessment for Planning Purposes. Bureau of Reclamation and the State of New Mexico. November 1976.)

<u>Station</u>	<u>Maxi- mum</u>	<u>Year of Occurrence</u>	<u>Mini- mum</u>	<u>Year of Occurrence</u>	<u>Aver- age</u>
Pecos River near Anton Chico	243.2	1958	21.4	1964	83.6
Gallinas Creek near Montezuma	41.8	1958	1.8	1956	14.4
Pecos River near Puerto de Luna	307.3	1958	72.8	1964	140.7
Pecos River below Sumner Dam	218.0	1958	85.0	1964	131.7
Rio Ruidoso at Hollywood	16.8	1958	3.0	1964	7.8
Pecos River at Carlsbad	83.6	1958	9.0	1965	39.1
Pecos River at Red Bluff	101.1	1958	19.3	1964	59.2

Sedimentary rocks, chiefly unconsolidated sand and gravel; and sandstone, are the important aquifers in this basin. Alluvial aquifers are generally stream-connected and are recharged by local precipitation and flood flows. Water levels in the shallow sand and gravel aquifers of this district have declined by about 40 feet since 1940. In the principal artesian aquifer, the static head has declined from 60 feet above the land surface in 1905 to about 20 feet below the land surface in 1970. These data are shown on hydrographs of observation wells southeast of Roswell and on portfolio map 16, "Observed Changes of Ground Water Level and Hydrographs of Selected Wells." These hydrographs are maintained at BLM's Roswell District Office. Map 16 also shows a decline of the water level in the Roswell Artesian Basin's southern end of approximately 225 feet. In the Carlsbad area, this decline has reached 20 feet and, in these areas, sizeable cones of depression have been created which extend eastward towards the Pecos River.

Under 1970 conditions, ground water depletions in the Pecos River Basin amounted to about 295,700 acre-feet, consisting of about 175,000 acre-feet of surface water and 120,000 acre-feet of water drawn from the deep aquifers. The Pecos River Basin has been estimated to contain 370 million acre-feet of recoverable fresh and slightly saline ground water, with another 25 million acre-feet of ground water containing less than 1,000 milligrams per liter of total dissolved solids also being available.

Under these circumstances, if present conditions of use and recharge continue, the natural discharge that appears as base inflow to the river will cease. The loss of this discharge will adversely affect all of this district's available water supply.

Water issuing from the headwaters region is of good quality. However, the quality of surface water is a serious problem throughout most of the Pecos River Basin. Dissolved solids in the river increase downstream to the extent that water quality becomes marginal in some places. Historically, the lower reach of the Pecos has been notorious as a saline river. As early as 1582, Spanish explorers noted salt springs and seeps along it's banks. The worse area is known as Malaga Bend where brine leaks upward from the aquifer and seeps into the river's already saline waters. These brine springs and seeps have been estimated to discharge about 420 tons of dissolved solids daily, of which 370 tons are sodium chloride. On February 25, 1954, a sample taken from the brine aquifer has a reported total concentration of dissolved solids which was 275,000 parts per million.

Although man's activities contribute to the poor quality of water in this river, the major cause is the soluble nature of the water-bearing formations underlying the basins and to those surface materials which are present in the watershed. Water of better quality is contributed by tributary streams, flood flows, and precipitation.

The quality of ground water presents few problems in the northern part of the Pecos River Basin, although in the Roswell area, the encroachment of saline water into the fresh artesian aquifer threatens irrigation and municipal supplies alike.

b. Texas-Gulf Basin

The Texas-Gulf Basin in New Mexico, commonly referred to as the Southern High Plains, is located in the eastern part of the State and contains about 5,487 square miles.

Subareas within the major drainage area are the Lea Plateau and the Brazos River. There are no perennial streams in the High Plains area, although a few intermittent streams may flow following summer thunderstorms which are common during July and August. Most precipitation either infiltrates the soil or evaporates. In the northern part of the area, a number of broad, shallow draws follow the slope of the plains and carry water only at times of heavy precipitation. These constitute the only semblance of surface drainage in this part of the High Plains. However, there are a number of natural lakes which intersect, or nearly intersect the water table. The usable average of annual surface water which is currently available in this basin is estimated to be 13,800 acre-feet.

While supplies of surface water are limited, large supplies of ground water can be found in most of the unconsolidated sands and gravels of the Ogallala Formation which underlies the Texas-Gulf Basin. However, large-scale pumping has resulted in a serious decline in the availability of this water and, in some areas of the Portales Valley, ground water is nearing depletion. Lands are being abandoned or water supplies are being drawn from distant sources.

The amount of ground water lost from the basin, under present conditions, is about 359,800 acre-feet. It has been estimated that about 30 million acre-feet of fresh ground water and 55 million acre-feet of slightly saline ground water are recoverable from aquifers underlying the Texas-Gulf Basin.

Although records are not available concerning the quality of surface water, potable ground water is generally available throughout this district. At a few localities, however, ground water drawn from greater depths may contain somewhat more than 250 miligrams per liter of either sulfates or chlorides. This water is very hard. Ground water ranging in quality from slightly saline to brine underlies this area in massive aquifers although they are generally located at progressively greater depths than is the more usable water.

B. Living Components

1. Vegetation

a. Aquatic Plants

Aquatic vegetation is limited within the Roswell District and is presently confined to small areas along the Pecos and Canadian Rivers and associated reservoirs. Wetland areas, especially along the rivers, were far more numerous in the past. A steady decline in this vegetative type has occurred since 1940 as channel and drainage projects have been constructed along with impoundment areas designed to benefit agricultural lands.

Aquatic sites are also critical habitat for migratory waterfowl which winter on both the Pecos and Canadian Rivers. Several of these sites have been incorporated into the federal and state wildlife refuge systems. In this environmental analysis area, Bitterlakes National Wildlife Refuge is one of these refuges. It is located on the Pecos River east of Roswell, New Mexico.

A listing of the district's water-associated vegetation is presented on Table 2. Primarily, this listing is of such vegetation as is located at Bitterlakes National Wildlife Refuge. It is considered to be typical of the district's wetland sites.

Table 2
Water-Associated Vegetation

(Source: A Manual of Aquatic Plants, Fassett, 1940)

<u>Common Name</u>	<u>Taxonomic Name</u>
Saltcedar	<i>Tamarix ramosissima</i>
Seep Willow	<i>Braccharis glutinosa</i>
Widgeongrass	<i>Ruppia meritima</i>
Muskgrass	<i>Chara</i> sp.
Saltgrass	<i>Distichlis stricta</i>
Scratchgrass	<i>Muhlenbergia asperifolia</i>
Marshcane	<i>Phragmites communis</i>
Wirerush	<i>Juncus</i> sp.
Sedge	<i>Scirpus</i> sp.
Cattail	<i>Typha</i> sp.
Pondweed	<i>Potamogeton</i> sp.

Special brackish-water green algae, *Batophora oerstedii*, is found only in gypsum sinks in southeastern New Mexico and in the area of the Gulf of Mexico.

At the present time, oil and gas operations have had little effect on aquatic vegetation along the rivers. Some diking and drainage of small areas to facilitate test drilling may have occurred in the past, but little evidence or documentation is available. No major oil spills have been documented on either of these river systems.

b. Terrestrial Plants

The entire district lies within two life zones: the Upper and Lower Sonoran. These zones contain seven major vegetative types: grassland, desert shrub, mesquite, shinnery oak, creosote bush, pinon-juniper, and saltcedar. The latter is located in the Pecos River bottom.

The grassland vegetative-type covers most of this district. Dropseeds and gramas are the principal grass species with the drainage bottoms being dominated by tobosa and sacaton and burrograss dominating the flats adjacent to the Pecos River Valley, intermingled with minor amounts of tobosa and grama grasses.

Many forbs can be found throughout the district. Their numbers fluctuate considerably from year-to-year, depending on moisture conditions.

In the district's east and southeastern areas, shinnery oak and mesquite are the dominant vegetative types. South and west of Carlsbad, New Mexico, desert shrubs and creosote are dominant. In the foothills of the Guadalupe and Sacramento Mountains along the district's western edge, and in the extreme north, near the towns of Corona and Santa Rosa, pinon-juniper trees can be found.

Oil and gas operations have affected plants to the extent that vegetation has been removed to facilitate the construction of roads, drill sites, and pipelines. The amount of this disturbance is related to the number of wells and to their depth. Shallow wells require smaller drilling pads than do deeper wells. This is due to equipment and materials requirements. Excavation of caliche pits also require removal of vegetation. (Appendix C lists terrestrial plants which occur in this area.)

2. Wildlife

The Roswell District's administrative boundaries encompass a wide variety of habitat types and associated animal life. Appendix D lists the different habitat types and related wildlife species that would be impacted by oil and gas activities (Source: East Roswell Grazing ES and Run Wild Program 1979).

At the present time, several groups of animals are receiving major management considerations from state and federal agencies. These groups can be segregated into the following four categories: game animals, migratory waterfowl, predators, and species classified as threatened or endangered (Appendix E).

The major big game species within the district are pronghorn antelope and mule deer. Approximately two-thirds of the district is classified as primary or potential antelope habitat. The majority of the primary habitat lies just east of the Pecos River and extends almost to the Texas border. The district produces approximately 40 percent of the antelope hunting opportunities in the state.

Mule deer are scattered throughout the district with major concentrations being located within the Capitan Mountains, the eastern portion of the Sacramento Mountains, and the Guadalupe Mountains. The Guadalupe Mountain deer herd is one of the more important in the state. Heavy pressure by hunters and a continuing high reproductive rate have established a continuous and ample supply of deer for hunter opportunities.

Texas White-tailed deer are fairly common in the Sacramento Mountains and a few are harvested every hunting season. The range of the sandhill deer, a remnant population of Texas White-tails, is found principally east of Roswell just below the Caprock escarpment. Historically, these deer ranged over all of the sand country east of the Pecos River. This range has been greatly reduced and this particular population of whitetails has declined to a few scattered animals.

Bear and turkey are found in a scattered distribution in the upper elevations of the western edge of the district. Most habitat for these species is limited to small areas within the district which are located on lands administered by the Forest Service.

Barbary sheep, an introduced species from Africa, are located on the Piedmont hills adjacent to the Hondo River. Limited hunts for this species have been held since 1967 and, at this time, the herds are apparently in a healthy condition and are expanding their range.

A wide variety of upland game species are native to the district. Mourning doves and scaled quail are well distributed over the entire area and support the bulk of upland hunting opportunities. The highly eruptive extremes in population fluctuations, characteristic of scaled quail populations, are less pronounced in this area as compared to other areas within the state. Presumably this difference is due to the more stable climatic conditions of southeastern New Mexico. Desert grasslands and sand country constitute the optimum habitat for these birds. Bobwhite quail are found on the eastern fringe of the district. This area represents the western limit of the geographic distribution of this particular species and is at best marginal habitat. Populations fluctuate markedly with climatic conditions.

From a management standpoint, the district's most important gamebird is the lesser prairie chicken. This bird is subject to high population fluctuations. With the level of relative abundance considered to be between 12,000 and 15,000 in the state. Present distribution is localized in areas of brush-grassland prairies (shinnery oak/sand sagebrush habitats) in the eastern and northeastern portions of the district. The major chicken population can be found in an area described in the Roswell District's Caprock Habitat Management Plan (HMP). This plan was completed in 1980. Hunters are attracted from throughout the United States to participate in hunting this game bird.

Although a few waterfowl reside yearlong within the boundaries of the district, the majority of waterfowl listed in Appendix D utilize the district only during migration and winter. All available surface water within the district is utilized by migrating waterfowl but important concentrations and wintering habitat are found only in the Pecos Valley.

A large percentage of the world's population of lesser sandhill cranes winter in southeastern New Mexico and adjacent portions of Texas. As many as 70,000 have been counted at one time on refuge roosts. Crane populations usually peak on the refuge in late October and then gradually disperse over the entire wintering area. Other important crane roosts are located along the Pecos River from Fort Sumner to Artesia and particularly on the playa lakes found in Roosevelt and Lea Counties.

Predatory animals which have received special attention are divided into two groups: avian predators (raptors), and mammalian predators. Year-round resident raptors include the golden eagle, Harris' hawk, great horned owl, burrowing owl, red-tailed hawk, marsh hawk, and kestrel. Ecologically, the district is extremely important as a migration and wintering range, concentrating large numbers of various raptors.

Notable mammalian predators include the coyote, bobcat, mountain lion, and four species of fox: kit, swift, gray, and red. Coyotes and bobcats are abundant district-wide and have been the target for extensive predator control programs, particularly on sheep grazing ranges and the surrounding areas west of the Pecos River. Mountain lions, which are regarded by the State of New Mexico as game animals, are relatively scarce and primarily confined to the mountainous and broken country on the western fringe of the district.

Fish populations are restricted to those few areas that maintain a yearlong supply of fresh water. Due to excessive siltation, shallow depth, and frequent drawdowns, reservoirs along the Pecos River provide little in the way of game fish habitat but abound with rough fish species. Alamogordo Lake, its tailwater, and the 14-mile section of the river between McMillan and Avalon Reservoirs provide moderate game fish habitat. Channel catfish, bluegill, white bass, and green sunfish are predominant game fish in the river. Nongame fish include gizzard shad, river carpsucker, gars, and carp.

Some year round fisheries habitat can be found on the Black River, a tributary of the Pecos River, located in the southernmost portion of the district. There is some stocking of livestock watering tanks and other storage structures with fish, but this practice is of a limited nature. During the Winter, trout are stocked in the Pecos River below McMillan Dam and in the Black River, by the New Mexico Department of Game and Fish (NMDG&F).

a. Threatened or Endangered Species

The Endangered Species Act of 1973 requires that all BLM actions be evaluated as to their effect on threatened or endangered species. It is Bureau policy to give equal consideration to state-

listed threatened or endangered species. Appendix E presents a list of threatened or endangered wildlife species that may occur in the Roswell District. This list was compiled from the 1979 NMDG&F "Handbook of Species Endangered in New Mexico."

For the Roswell District, the following plant species are listed as threatened or endangered as of April 7, 1980, pursuant to this Act.

- 1) Kuenzler Hedgehog Cactus, *Echinocerus kuenzlerii*, (endangered), (Castetter, Pierce, and Schwerein) Benson, Cactus and Succulents Society Journal 48:77-82

Range: Apparently limited to the Rio Elk Canyon on the east slope of the Sacramento Mountains. Could occur elsewhere in the area.

Type Locality: Elk, New Mexico, Horst Kuenzler (3585), May 5, 1968, University of New Mexico, 55571.

Habitat: Growing only on gently sloping limestone outcrops. *E. kuenzleri* appears as very scattered individuals which are located in rock crevices. A pinon-juniper association dominates the area with many of the species of a more mesic low woodland.

- 2) Lee Pincushion Cactus, *Coryphantha sneedii* var *leei* (Rose). Benson, The Cacti of the United States and Canada. New Names and Nomenclatural Combinations; Cactus and Succulents Society Journal 41:185-190, 1969.

Type Locality: Known only in Rattlesnake Canyon and it's tributaries within the Carlsbad Caverns National Park.

Habitat: The tops of limestone ridges. Most plants grow within the cracks of rocks on north-facing slopes.

Two other plant species, Gyp Buckwheat, *Eriogonum gypsophilum*, Woot. and Standl. Contr., U. S. Nat. Herb. 16:118, and Mc Kittnick's Pennyroyal, *Hedoma apiculatum*, are presently being proposed

by the U. S. Fish and Wildlife Service to be listed as threatened under 50 CFR 17. Additionally, the area containing this species is being proposed as critical habitat. This plant is only known to occur on the Seven River Hills, southwest of Lakewood in Eddy County, New Mexico. It's habitat is semi-arid hillsides with layers of pure gypsum crystals showing. These plants grow in the gypsum layers. In the past, this plant has been disturbed by off-road vehicle use in the habitat area, and by construction of a caliche road which is being used in oil and gas development. The current list of threatened or endangered plant species can be updated by additions or deletions as new biological information becomes available.

Under the proposed action with attached standard stipulations and mitigation measures a "no effect" determination could be made for the listed federal and state threatened or endangered species.

The Bureau of Land Management is responsible for assuring that potential effects on any sensitive, threatened, or endangered animal or plant species are evaluated before any leases are issued or before any actions on a lease are authorized. If any adverse effects are found, some restrictions may be necessary. In extreme cases, a lease may not be issued, or a well site may be relocated.

The lessee/operator may be authorized to conduct this impact evaluation at his own expense. However, should this be permitted, the evaluation must be completed by, or under the supervision of, a qualified resource specialist who meets the district manager's approval. Upon completion of this evaluation, an acceptable report must be provided to the district manager and must identify the effects of the proposed action on threatened or endangered species or their habitat which can be anticipated. Alternatives and/or proposed mitigating measures must also be considered where impacts can be expected.

C. Human Values

1. Recreation

Recreational uses on public lands in the Roswell District primarily involve extensive activities which are not dependent upon physical developments. Recreational values on most of this district's public lands have been considered in first generation land use plans. A smaller portion of the district, known as the East Roswell Area, has received second generation land use planning. Some of the public lands in the western and northern portions of the district have not been included in any land use plans.

The East Roswell Area, which includes public lands east of the Pecos River in Chaves, Eddy, and Lea Counties, has been inventoried for recreational potential using the Bureau's Recreation Information System (RIS). These procedures determine the inherent recreational values of natural resources on public lands as well as statistics for current and projected visitor use (for further information, see Bureau Manuals 6110, 6111, and 6112). According to BLM planning criteria (BLM Manual 6111), inventory of the public lands in this area showed that opportunities for winter sports, water sports, collecting, and sightseeing varied from severely limited to nonexistent. These activities are limited due to either problems with the climate or because the necessary resources are not available on those public lands being administered by the BLM.

Hunting is the most frequent recreation activity, accounting for about 18,300 visitor days on public lands in 1977. Animals hunted included mule deer, pronghorned antelope, dove, quail, lesser prairie chicken, pheasant, ducks, geese, lesser sandhill crane, coyote, and rabbit. All of the area's public lands are legally open to hunting, but some lands are not physically accessible due to restrictions imposed by nonpublic land. Fishing is second in popularity, accounting for approximately 2,500 visitor days, all on the Pecos River. The use of off-road vehicles (ORVs) ranks third in popularity. This use accounted for about 1,700 visitor days in 1977.

According to New Mexico's 1976 Statewide Comprehensive Outdoor Recreation Plan (SCORP), the following recreational activities are most important in the Roswell District; horseback riding, fishing, photography, picnicking, sightseeing, hiking, birdwatching, camping, visiting historical sites, small game hunting, trailbiking/4-wheeling, and rockhounding. Some of these activities also take place in urban environments and do not accurately reflect uses occurring on public lands.

Decisions based on BLM land use plans call for the protective management of three areas in this district: the Mathers Natural Area, the proposed Guadalupe Wilderness, and the Mescalero Sands area. Potential development opportunities were identified for the Haystack Mountain, North Dunes, and Red Bluffs recreation sites. Off-road vehicle designations proposed in land use plans for the East Roswell Area were completed on October 9, 1979. These designations include about 44 percent of the district's public lands. Protective stipulations to implement recreation land use decisions are included as standard operating procedures in the proposed action.

The Roswell District contains an estimated 500 caves, with 200 actually having been located. Thirty of these have been intensively inventoried and 22 have had gates and/or fences installed. The first cave management program in the Bureau was developed in this district, beginning in 1967, due to the intensity of public interest and abundance of cave resources. Caves in Southeastern New Mexico have also achieved national or international significance due to their scientific or recreational values. Two BLM-managed caves are designated and registered National Natural Landmarks (Fort Stanton and Torgac Caves) while five other caves at McKittrick Hill are currently being considered for landmark designation.

Recreational use of some of the gated caves where entrance permits are issued has increased from 1286 cave visits in 1975 to 2344 in 1979, but the number of permits issued has declined during the past two years. Use records or valid estimates of the number of visits are not available for those caves which are not subject to permit requirements.

During 1970, eleven caves were segregated from appropriation under the general mining and public land laws, in order to protect their fragile resource values. One other cave was segregated from appropriation under the mineral leasing, public land, and general mining laws. A stipulation for the protection of cave resources is included as a standard operating procedure in the proposed action.

2. Wilderness

Nine inventory units in the Roswell District are, currently under consideration as wilderness study areas (WSAs). These studies were instigated because the Federal Land Policy and Management Act (FLPMA) directs the Secretary of the Interior to review all roadless areas of the public lands which total 5,000 or more contiguous acres for their wilderness potential. Those roadless areas with less than 5,000 acres but which are contiguous with lands being managed by another federal agency are also subject to review, if those other federal lands have been formally determined to have present or potential wilderness values.

Section 603(a) of FLPMA provides that the BLM shall review the wilderness potential of its natural and primitive areas designated before November 1, 1975, which are known as "Wilderness Instant Study Areas." Section 603(c) of FLPMA requires that lands under wilderness review shall be managed in a manner which would not impair the suitability of such areas for preservation as wilderness.

However, existing mining, grazing, and mineral leasing uses were specifically exempted from the nonimpairment standard contained in Section 603(c) and most of the wilderness study areas of this district are already under existing leases.

The BLM has developed the following framework to accomplish the mandate of Section 603 of FLPMA for the wilderness program which covers the following elements:

- a. Wilderness Review - The wilderness review process has three phases: inventory, study, and the report to Congress.
 1. Inventory - The inventory phase involves locating those areas of the public lands which contain wilderness resources and determining if they meet the criteria established by Congress. Such areas are then identified as wilderness study areas (WSAs).
 2. Study - The study phase involves the process of determining, through careful analysis, which wilderness study areas will be recommended as suitable for wilderness designation and which will be recommended as unsuitable. These determinations are made through the BLM's land use planning system and consider all values, resources, and uses of the public lands.
 3. Reporting - The reporting phase consists of actually forwarding these recommendations concerning suitability through the Secretary of the Interior and the President to Congress. Mineral surveys required by the law, environmental statements, and other data are also submitted along with these recommendations.
- b. Instant Study Areas - The law states that wilderness recommendations on all public land areas which were formally designated as natural or primitive areas prior to November 1, 1975, will be reported to the President by July 1, 1980. There are 55 such areas on the public lands in the United States.

- c. Interim Management - Congress also requires that BLM will manage lands which meet the legal criteria for wilderness study areas in such a way, and in accordance with the law, as not to impair their suitability for wilderness designation by Congress until that body designates such areas as wilderness or denies such designation by legislative action.
- d. Long-term Wilderness Management - Congress makes the final determination concerning wilderness designation for each area. Once designated, these additions to the national wilderness preservation system are managed by BLM according to provisions of the 1964 Wilderness Act and the 1976 Federal Land Policy and Management Act.

The wilderness inventory phase for public lands in New Mexico was completed on November 14, 1980, although Bureau decisions are subject to appeal procedures and may be modified. As they affect lands in the Roswell District, these decisions include inventory units in the following categories which are still under wilderness review:

- a. Four units containing 29,511 acres of the public lands have been selected as "wilderness study areas (WSAs);"
- b. A BLM decision concerning wilderness study area (WSA) identification for four units containing 4,830 acres was deferred, pending decisions on contiguous Forest Service or National Park Service lands;
- c. A decision was also made to drop one unit containing 10,540 acres from wilderness review;
- d. The Mathers Natural Area, an "instant" WSA containing 362 acres, has been reported to the Secretary of the Interior as being unsuitable for wilderness designation.

Public lands which are selected as wilderness study areas, will be studied in the Bureau's land use planning system. Bureau recommendations from this study process are scheduled to be completed by September 1987. A final decision concerning designation of the area as a wilderness may be made by Congress after reports and recommendations have been submitted.

3. Cultural Values

The Cultural Resources portion of this environmental assessment is based on the Class I Cultural Resource Overview (Camilli and Allen, 1979) which is on file at the Bureau of Land Management's (BLM's) Roswell District Office.

a. Prehistoric Use

Prehistoric occupation of the Roswell District began about 12,000 years ago. In fact, some of the earliest evidence of Man's presence in the New World has been found in this district. Such sites include Blackwater Draw near Portales and cave sites within the Guadalupe Mountains.

Early man seems to have occupied sites within this district from Paleo-Indian through the Archaic and into Ceramic periods. For much of this area, subsistence patterns and site types do not change substantially between the Archaic and Ceramic periods. Where subsistence continued to be based on hunting and gathering, the sites remain as campsites, with no permanent habitation structures. Pottery appears on the Ceramic-phase sites but not on Archaic sites.

Along the Pecos and Canadian Rivers, and in the Sacramento Mountains, there appears to be evidence of a definite transition from the hunting and gathering subsistence tradition of the Archaic Period to a subsistence based on agriculture. Permanent habitation sites such as pueblos are associated with this period.

Caves and rock shelters in the Guadalupe Mountains seem to have been used throughout all these periods. During the Ceramic Period, the people employed ring middens or mesal pits to roast agave roots for food.

b. Historical Use

At first, use of this area during historic times was based on the grazing of cattle on large ranches. Passage of the Homestead Act helped to change settlement patterns in this area from open rangeland to smaller, fenced ranches.

The first major change in the pastoral dominance of this area began in the 1920's with the development of the potash and oil and gas industries which continue to be important to the area.

Sites involved with the evaluation of early man in this area became more important as southeastern New Mexico began to develop. With the growth of cultural awareness in this area, these sites became important for the information that they provide about the past, including

man's use and abuse of the environment and their consequences. Information is obtained from the artifacts, their relationships to each other on the site, and through the variety of analysis which are possible, e.g.: radiocarbon dating, pollen analysis, and thermoluminescence, to name a few.

Approximately 520 cultural resource sites have been inventoried on public lands within the Roswell District. In addition to these sites, 75 similar sites have been inventoried on lands where the surface rights are privately owned but where the federal government retains all mineral rights, three on lands where the state owns surface rights and the federal government owns mineral rights, with one site being located in a wildlife refuge. In this latter instance, the federal government also owns the mineral rights. Finally, 63 sites have been located on "withdrawn" lands.

Several sites in the Roswell District have been listed on the National Register of Historic Places, while others have been nominated for such listing, and still others have been determined to be eligible for nomination to the National Register.

As of July 1980, Feather Cave is listed on the National Register and both the Mescalero Sands Archeological District and Pope's Artesian Well/Camp Site have been nominated for such listing. Sites which have been determined to be eligible for inclusion on the National Register include: Maroon Cliffs Archeological District, AR-6-73; AR-30-6-30; HI-30-6-190 (the Potash Bull Wheel), AR-30-6-1034, AR-30-6-1047 (MS-C9), Sites LA-11809 through LA-11822, Archeological District (Brantley Dam), the Laguna Plata Archeological District, and the Waste Isolation Pilot Project (WIPP) area.

New Mexico's State Historic Preservation officer and the BLM's representative met in consultation on July 1980. At that time it was agreed that the following sites appear to meet the criteria of eligibility to the National Register:

NM-06-1630, 1632, 1629, 1631, 354, 939, 1855, 702,
1938, 1813, 1851, 1852, 1842, 1856, 1853, 954, 952,
1131, 1089, 299, 267, 290, 291, 2088, 307, 2117,
2118, 993, 973, 950, 970, 946, 947, 1113, 1155,
1159, 794, 586, 1956.

Consultation with the Advisory Council on Historic places concerning the eligibility of sites is proceeding.

4. Visual Resources

Visual characteristics within the Roswell District are a combination of topographic relief, vegetative cover, and manmade alterations

(cultural modifications). The district's visual character can best be summarized as a low, rolling prairie which is bisected by the north to south trend of the Pecos River valley, blending into a mountainous landscape to the west. Topographic characteristics are described in this nonliving components section. Vegetative characteristics are described in the living components section of this chapter and, therefore, will not be repeated here.

Cultural modifications are scattered throughout this area and include fences, stock watering facilities, ranch buildings, oil and gas exploration and production facilities, highways, roads, potash refineries, pipelines, powerlines, railroads, and vegetative treatments. Depending on the attitude of the viewer, all these modifications may or may not be seen as visual intrusions. Although most facilities located on public lands will cause an impact to scenic quality, some facilities, windmills in particular, are considered by many people to be symbols of the western lifestyle and to add a certain charm. In intensively developed oil and gas fields, the facilities give a busy appearance to the landscape and dominate the scene. Potash refineries also tend to dominate their localities.

Landscape character in about 97 percent of the area has been inventoried and rated according to the Bureau's Visual Resource Management (VRM) system. There are two phases to this system: 1. determination of the permanent or interim VRM class, and 2. determination of contrast ratings for proposed projects. How contrast ratings and VRM Classes are determined is discussed in Chapter 3. The visual or scenic value of an area indicates its VRM classification with visual quality, visual sensitivity, and visual distance being considered.

Visual quality is the relative level of natural beauty of a landscape, in terms of the form, line, color, and texture of the topography, vegetation, and structures. These are rated by using a matrix which considers landform, color, water, vegetation, uniqueness, and intrusions. Application of this matrix to a given area produces a numerical rating for scenery which is translated into "A" for high quality; "B" for average; or "C" for low quality. Visual sensitivity is the measure of the public's concern for an area's visual quality. Visual distance is that portion of a landscape which is visible from major travel routes or use areas. (For a discussion of Visual Resource management procedures, see BLM Manual, Sections 8411 and 8431.)

There are five possible classes in the VRM system. Class I primarily provides for natural ecological changes and is applied to primitive/wilderness areas, some natural areas, and other similar situations where management activities are to be restricted. Class II provides that changes in any of the basic elements (form, line, color, or texture) caused by a management activity should not be evident in the characteristic landscape. Class III provides that changes in the basic elements

caused by a management activity may be evident in the characteristic landscape. Class III provides that changes in the basic elements caused by a management activity may be evident in the characteristic landscape, but should remain subordinate to the existing visual quality. Class IV provides that changes in the basic elements may subordinate the original form, line, color, and texture. Class V is a temporary classification which indicates that change is needed. It is applied to areas where the natural character has been disturbed to the point where rehabilitation is needed.

Four of the five possible VRM classes have been assigned to those portions of Chaves, Eddy, and Lea Counties located east of the Pecos River. The proposed Mathers Research Natural Area (RNA) and the Mescalero Sands Outstanding Natural Area (ONA) are both designated as being in VRM Class I. The Mathers RNA has approximately 96 acres and the Mescalero Sands ONA has approximately 6,293 acres for a total of about 6,389 acres (less than 0.1 percent) of the public lands designated as VRM Class I.

The northern portion of Comanche Hill and the Pecos River basin from the Chaves/Eddy County line south are listed as VRM Class II areas. They include approximately 10,400 acres (less than 0.7 percent) of the public lands.

There are six areas totaling approximately 73,560 acres (less than 5 percent) of the area's public lands which are VRM Class III. These include areas along U. S. Highways 70/380, 62/180 (N. M. 31), Mescalero Sands, Mescalero Ridge, Maroon Cliffs and Livingstone Ridge, and Laguna Gatuna. The visual quality along the highways is not appreciably higher than that of the rest of the area. They are included in VRM Class III primarily because of their higher visual sensitivity. Approximately 95 percent of the public lands within this study area (1,512,803 Acres) are listed as VRM Class IV.

The remainder of the public lands in the Roswell District, approximately 2,023,000 acres, have not been formally classified for VRM purposes. However, except for western Lincoln County, all of this area has been inventoried and an interim VRM classification can be determined in order to assess impacts from oil and gas development. The acreages which would be included in each interim VRM class have not been tabulated at this time, but it can be assumed that the proportion of lands in each category would be similar to the area where final VRM classes have been designated.

5. Socioeconomics

The social environment of southeastern New Mexico is primarily influenced by four varied cultures (in order of the degree of impact): Anglo, Spanish, Mexican, and Black. There are also small numbers of other ethnic minorities, including Native American and Oriental. Some are prominent in the business and professional communities. The state's southeastern corner is based economically on three industries: oil and gas, potash mining, and the agribusiness community which includes ranching. A fourth major economic support for this area is government. Local, state, and federal employment, plus the various subsidies to individuals and businesses, are crucial to the regional economy.

a. Economic Environment

While the overall economy of New Mexico started to show signs of slowing in 1979, primarily in the areas of construction, employment, tourism, and retail trades, the state was insulated from the most severe effects of a recession because of its position as this nation's eighth largest producer of minerals, with large resources of oil, gas, potash, and uranium. In 1978, potash sales were valued at \$183,554,000, while the total of all oil and gas-related sales was \$2,293,159,000. In 1979, these totals reached \$226,900,000 for potash and just under \$3 billion for oil and gas. As New Mexico's largest producer of petroleum products, the state's southeastern corner shared in this energy-related growth and its profits. However, during 1976-79, only 30 percent of New Mexico's oil production was refined in the state (New Mexico Progress, 1979 Economic Report, Vol. 47).

The oil and gas industry can be expected to have a major effect on the social and economic environment of four southeastern New Mexico counties over the next 20 years. These are: Chaves, Eddy, Lea, and Roosevelt. There is also the possibility that Curry and some of the other counties in this area may become producers during this period (New Mexico Progress, 1979 Economic Report).

In the early 1970's, 30 to 40 percent of this area's work force earned all or a substantial part of their income from the oil and gas industries, while many others were employed in the potash-related industries. Even though these statistics were compiled during a period of dwindling activity, at that time, over 9,000 people in the state were directly employed by the oil and gas industries. By 1979, the number of oil and gas workers had increased to 8,383 in southeastern New Mexico and this level of employment can be expected to increase during the next 15 to 20 years, with concurrent increases in other facets of southeastern New Mexico's economy.

Table 3

1978 AND 1979 EMPLOYMENT IN OIL AND GAS INDUSTRIES
BY COUNTY, WITH PERCENTAGE INCREASES

(Source: Employer's Quarterly Wage Report as reported by the New Mexico Employment Security Commission's Roswell Office, June 1980.)

COUNTY	DECEMBER 1978	DECEMBER 1979	PERCENTAGE OF INCREASE
Lea	5934	6626	11.6
Eddy	937	1186	26.5
Chaves	307	464	51.0
Roosevelt	57	107	87.8
Total	7235	8383	16.0

Many of these new jobs should be stable through the life of productive fields, since the general policy of the oil and gas industry is to hire local workers for about 10 to 15 percent of their field crews, train them, and to employ them during the production phase of these new fields. The majority of most drilling crews are long-term employees of the drilling and exploration companies and are migratory.

While unemployment averaged 6.6 percent in New Mexico overall, the four-county area discussed in this analysis reported an average of less than 5 percent. By counties, unemployment percentages in southeastern New Mexico during 1979 were: Chaves 4.9, Eddy 4.8, Lea 4.2, and Roosevelt 3.3.

Two of the prime economic indicators for this area, natural gas and crude oil production, reported sales valued at \$1.6 billion and \$1.1 billion respectively during the year. Sales in southeastern New Mexico alone totaled \$1,734,874,000 with Lea County leading the way by producing 49,491,000 barrels valued at \$658,363,000, followed by Eddy County with 19,916,000 barrels valued at \$295,438,000. In Chaves county, oil and gas production was 1,902,000 barrels, which sold for \$37,134,000, while Roosevelt County pumped 1,711,000 barrels which returned \$29,910,000.

TABLE 4

1978 AND 1979 OIL AND GAS SALES, BY COUNTY

(Source: New Mexico Progress, 1979 Economic Report, Vol. 47. Published by First New Mexico Bankshare Corporation.)

OIL SALES

COUNTY	VOLUME IN BARRELS		DOLLAR VALUE	
	1978	1979	1978	1979
Lea	52,273,000	49,491,000	476,977,000	658,362,000
Eddy	22,411,000	19,916,000	264,787,000	295,438,000
Chaves	1,501,000	1,902,000	18,428,000	37,134,000
Roosevelt	1,316,000	1,711,000	15,052,000	29,910,000
Total	77,501,000	73,020,000	775,644,000	1,020,844,000

Natural gas production, by counties, was: Lea 344,721,000 million cubic feet (MMCF), valued at \$358,734,000; Eddy 228,005,000 MMCF, valued at \$338,733,000; Chaves 9,130,000 MMCF valued at \$11,962,000; while Roosevelt reported 3,639,000 MCF valued at \$4,590,000.

TABLE 5

1978 AND 1979 NATURAL GAS SALES, BY COUNTY

(Source: New Mexico Progress, 1979 Economic Report, Vol. 47. Published by First New Mexico Bankshare Corporation.)

NATURAL GAS SALES

COUNTY	VOLUME (MMCF)		DOLLAR VALUE	
	1978	1979	1978	1979
Lea	364,562,000	344,721,000	289,613,000	358,734,000
Eddy	225,093,000	228,005,000	253,578,000	338,733,000
Chaves	10,624,000	9,130,000	10,885,000	11,962,000
Roosevelt	3,398,000	3,639,000	3,069,000	4,590,000
Total	603,679,000	586,495,000	546,145,000	714,019,000

Exploration is expected to continue and to expand into other areas of the district, with most new activity taking place in the northern portions of Chaves and Roosevelt Counties and in southern Curry County. In 1979, there were over 8,000 oil and gas leases in the BLM's Roswell District with about one-third of an estimated 19,000 producing wells being located on federal land.

Two of the most important factors in New Mexico's economy are the royalties and taxes paid to the state and local governments from oil and gas production originating on federal lands. In 1971, New Mexico's portion of federal royalties on oil and gas production on federal lands was over \$102 million, in addition to \$41 million which was collected from the gasoline tax. In 1979, royalties from the federal lands within New Mexico were over \$74 million for the state, with 31 counties sharing over \$9.6 million in federal revenue in lieu of taxes. In 1971, New Mexico's per capita income from these sources was approximately \$100 for each man, woman, and child. By 1979, diminishing oil and gas activity had reduced this to \$74 with the state receiving just over \$74.37 million. With the current increase in oil and gas production, over \$52 million was paid to the state treasury during the first six months of fiscal year 1980.

New Mexico's tax base is also considered to be low, thus the revenue received from federal oil and gas royalties helps in financing essential services within the state. As the level of activity in these industries increases throughout southeastern New Mexico, these royalties will contribute even more to the state. Predictions for increases appear to be soundly based, considering that the Carlsbad area had experienced a 60 percent increase in oil and gas activity during the first half of 1980, together with the increases in employment which will result from the construction of the MAPCO pipeline, the Shell CO₂ pipeline, and of new processing plants being proposed near Roswell.

b. Social Environment

The overall social environment must be divided into two segments. These are the urban and agribusiness communities. While there is a considerable sociocultural interplay between these two groups, there are also conflicts.

For the urban population, expansion of the oil and gas industries poses little problem but offers many gains in the form of increased employment opportunities and their attendant benefits.

For the agribusiness community, the social environment would change. Ranching has been a basic element of southeastern New Mexico's economy for more than a century, and was dominant for many years. In recent decades, ranching and other forms of agribusiness have

been surpassed in regional economic importance by mining and manufacturing, but remain as major industries, employing 3,890 persons in 1977 (U. S. Bureau of Economic Analysis, 1979). In January, 1978, the value of all cattle and sheep for DeBaca, Chaves, Curry, Eddy, Guadalupe, Lea, Lincoln, Quay, and Roosevelt Counties was \$140,525,500 (New Mexico Agricultural Statistics, 1978).

Families engaged in farming and/or ranching in southeastern New Mexico are in a period of transition. While they emphasize the importance of independence, self-reliance, and outside work, some younger members are employed in potash, oil and gas, or other minerals industries, with many holding key positions. These jobs are often made possible by the federal leasing program.

Many of these families consider that ranch work and it's related lifestyles are a preferred way of life which is more natural than life in an urban environment. Ranch families adhere to what they consider as a "western way of life," one which they inherited from pioneer ancestors. Despite poor financial returns from ranching, they persist in ranch lifestyles (P-6, Socioeconomic study of East Roswell EIS Area, Harbridge House, June, 1979). In doing so, they express their belief that ranching leads to a higher state of well-being than does an alternate way of life.

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND IT'S ALTERNATIVES



Chapter 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ITS ALTERNATIVES

This chapter identifies and analyzes impacts of the proposed action on the human environment. Each impact is analyzed in a "cause-and-effect" manner, by resource component. The "cause" is tied to a component of the proposal which is described in Chapter 1, while the "effect" is tied to a component of the environment which is described in Chapter 2.

Impacts of the proposed action are presented in two levels. Level 1 deals with those impacts which would result from implementation of the proposed action, assuming that full compliance with standard operating procedures listed in Appendix A could be achieved.

Level 2 impacts would be the result of the level of noncompliance which can be expected, based on a long history of experience in this field. BLM specialists can predict these impacts because the proposed action deals with continuation of an existing program, rather than with the beginning of a new program. Their predictions are based on documented observations.

Noncompliance is the result of many factors, one of which is the lack of manpower. The United States Geological Survey (USGS) is responsible for enforcing compliance with stipulations. However, that agency experiences manpower shortages, as does the Bureau of Land Management (BLM), together with shifts in priorities which make complete enforcement difficult. Another problem is that USGS and BLM operate under different mandates and their priorities are not always identical.

By discussing these impacts at two levels, the decision-maker and the public can determine the relative difference in impacts and can decide which particular operations require compliance most, and if additional measures to protect the environment are required. When both levels would result in the same impacts, both are discussed under level 1. After impacts have been discussed, mitigating measures which are available to the manager on a case-by-case basis are presented. These do not necessarily have the concurrence of USGS at this time and differ from the standard operating procedures which have already received USGS concurrence and are designed for district-wide application.

1. Topography

a. Impacts

Topography can be affected by construction associated with the three facets of oil and gas production: exploratory drilling, development, and production. Drill pads, tank batteries, pump stations, etc., all require level areas. This is not normally a problem in the Pecos River Valley or in the upland plains southeast of the river, but leveled hilltops and cut-and-fill construction near valley walls or escarpments are common in the hilly and mountainous areas of west Eddy County.

Should exploration and development extend into central Lincoln County or into parts of Quay, DeBaca, and Guadalupe Counties, these impacts would become more pronounced. In addition, roads which were constructed to facilitate oil and gas exploration and development could involve cut-and-fill construction and provide a channel for additional erosion.

b. Mitigation

Implementation of standard operating procedures which are listed in the proposed action, would serve to minimize the effect of construction activity on topography. However, even with these measures, some effect on regional topographical features would be inevitable. To mitigate these impacts over the long term, the lessee could be required to return the land to it's original contours upon abandonment.

c. Adverse Impacts Which Cannot Be Avoided

It is not possible to return the land to it's original contours in some very rocky and high relief areas. Such areas are found in the western part of the district, primarily in Eddy, and Lincoln Counties, the Caprock, and the mesas of Quay, Guadalupe, and DeBaca Counties.

d. Relationship Between Short-term Use and Long-term Productivity

Short-term use (20-30 years) for oil and gas activity would have a major impact on the topography only in high relief areas. Implementation of standard operating procedures, preconstruction field examinations, and proper abandonment procedures would minimize this impact. In the long-term, the quality of topographical character would not be affected to a large degree.

e. Irreversible and Irretrievable Commitment of Resources

Topographical features would be slightly affected under the proposed action. Erosion may intensify these adverse effects.

2. Geology

a. Impacts

Geologic structures would be affected both positively and negatively under the proposed action. In areas where the presence of caves is not known, exploratory drilling could damage these resources by causing the collapse of ceilings and through damaging natural formations. Even though there are no known caves in some areas of southeastern New Mexico, they may be discovered in any area which is underlain by limestone or gypsum formations. These conditions exist in most of the Roswell District, although areas of frequent occurrence have been classified and mitigated by the standard operating procedures. Damage to the scientific value of caves could include direct destruction of formations, partial or total collapse of the cave, or spillage of drilling fluids.

Various mineral resources would be produced as a result of implementing the proposed action. Oil and gas would be removed and caliche would be mined to provide surfacing material for access roads and drill pads. Potable water and brines would be produced by wells and either disposed of or used in the drilling process.

Geologic information would become more readily available as seismic studies, exploratory drilling, and developmental construction are undertaken. The information gained would then be available for a variety of studies and projections by governmental and private organizations, industry, schools and universities, and by individuals.

b. Mitigation

None.

c. Adverse Impacts Which Cannot Be Avoided

Same as for Impacts.

d. Relationship Between Short-term Use and Long-term Productivity

In the short-term, oil and gas resources would be depleted. This would be an unavoidable impact for long-term productivity. However, the proposed action would encourage additional exploration and the development of undiscovered resources as they are located.

e. Irreversible and Irrecoverable Commitment of Resources

Nonrenewable resources such as oil and gas, water, brines, and caliche would be removed as a result of the proposed action.

3. Paleontology

a. Impacts

Implementation of the proposed action may significantly impact vertebrate fossils which can be found in the terrestrial sediments of either the Mesozoic or Cenozoic Ages. Invertebrate remains would not be impacted significantly because large numbers of these fossils are commonly found in marine sediments of the Roswell District.

Direct impacts include destruction or disruption of exposed paleontologic occurrences by activities involved in oil and gas exploration and construction. Creation of additional roads would provide more access routes for the public and would increase human activity in many areas. As a result, the unauthorized collection of fossils would increase. The use of caliche or gravel for construction may also cause additional destruction, since vertebrate fossils are sometimes associated with such deposits.

Paleontologic information may become increasingly more available if the proposed action is implemented. Such information is presently lacking for most of the area being considered. Any increase in knowledge would benefit government planning efforts and could be used by institutions of learning or by individuals for a variety of studies and projects.

b. Mitigation

Destruction and disruption of paleontologic resources could be minimized by requiring clearances for all surface-disturbing activities in areas likely to affect the resource. These areas can be identified by referring to detailed geologic maps on a case-by-case basis. Should construction activities reveal any new paleontologic sites, construction could be delayed until salvage efforts are undertaken. Construction could also be relocated, if the site were judged to have enough significance as to warrant such drastic action.

c. Adverse Impacts Which Cannot Be Avoided

Implementation of any action which permits continuation of oil and gas exploration and development could result in the destruction of some paleontologic resources. This would occur regardless of the care taken to protect this resource or of the mitigating actions undertaken. Also, some collection of these resources by individuals is unavoidable.

d. Relationship Between Short-term Use and Long-term Productivity

Implementation of the proposed action would increase the availability of information concerning paleontologic resources in this region and would aid in the identification of sites which could be considered for preservation or salvage. Over the long-term, the actual number of surface sites can be expected to be reduced.

e. Irreversible and Irretrievable Commitment of Resources

Some paleontologic sites would be destroyed if the proposed action is implemented and the knowledge which might have been gathered from those sites would be lost. This would be unavoidable.

4. Land Use, Minerals

a. Impacts

The proposed action has a potential for preventing the extraction of other valuable minerals in the short-term. However, after petroleum products have been removed, other minerals may be mined in sequence.

Other valuable minerals possibly occurring in the Roswell District and which may be affected by the proposed action include evaporites such as potash, halite, gypsum and sulphur, plus locatable minerals such as uranium, thorium, copper, iron, gold, silver, etc. These valuable minerals would also include common resources such as caliche, sand and gravel, and building stone.

Oil and gas activity stimulates the construction industry and the production of mineral materials indirectly, especially caliche. Caliche is used as the base material and as surfacing for roads and drilling pads.

b. Mitigation

Possible mitigating measures include: (1) delaying oil and gas production until other mineral resources have been removed: (2) sequential production of oil and gas, followed by production of other minerals: (3) simultaneous extraction of all mineral values whenever possible: (4) production of the most valuable minerals on a demand basis; or (5) production of mineral values in line with historic use. Another possibility would be to observe the U. S. Geologic Survey's policy concerning known Geologic structure and Resource Area, such as the potash area. (See Map #4, Appendix A.) The Secretary of Interior's order of Oct. 18, 1951, as amended May 11, 1965, established the potash area withdrawal. Conflicts are resolved through the New Mexico Oil and Gas Commission's Order No. R-111A. This order was issued to "prevent waste, protect correlative rights, assure maximum conservation of oil and gas resources in New Mexico, and permit simultaneous recovery of potash minerals ..."

Such mitigation must be decided on a case-by-case basis since exact circumstances are difficult to predict.

c. Adverse Impacts Which Cannot Be Avoided

Should oil and gas production become the major use of a particular tract of land, production of other mineral values may be delayed or prevented to some degree, depending on the type of mineral resource and method of extraction.

d. Relationship Between Short-term Use and Long-term Productivity

In the short-term, energy resources would be produced as a result of the proposed action. In the long-term, oil and gas resources would be depleted although exploration may continue to add somewhat to the known quantities of this resource. Other minerals may be produced prior to, during, or after oil and gas development. For this reason, short-term use under the proposed action would not actually limit long-term production of other mineral resources.

e. Irreversible and Irrecoverable Commitment of Resources

Some mineral resource values would be permanently lost due to implementation of the proposed action, especially with respect to pillar areas surrounding abandoned wells. These areas would not be mined under current policy.

5. Soils

a. Impacts

Level 1: There are many negative impacts to the soils during the exploration phase of oil and gas activity. Off-road vehicles, seismic activity and drilling of test wells, excavation of caliche and of sand and gravel, and the building of both service roads and drilling pads all cause soil particles to become unconsolidated and increase the soil's susceptibility to both wind and water erosion.

Because of the density of compacted caliche, construction of roads and drilling pads would cause nearby soils to be influenced by the additional runoff during rainstorms, increasing the effect of erosion. Also, because of this increased runoff, erosion would increase on sites with slopes of greater than 3 percent. On sites in sandy areas, erosion would be increased as the soil's susceptibility to the wind increased because of surface disturbances. The disposal of drilling mud and dumping of waste oil in sump pits would contaminate soils in the area of drilling sites and these contaminants would be expected to remain in place after drilling sites have been rehabilitated. Such contaminants would not be expected to translocate in the soils more than a few feet.

b. Mitigation

On areas where the available top soils are shallow, these soils should be stockpiled for later rehabilitation of the sites.

c. Adverse Impacts Which Cannot Be Avoided

Implementation of the proposed action would leave some residual impacts which would be adverse. Because of the use of caliche in construction of roads and pads, it may not be possible to revegetate these areas to approximate their natural condition. On those sites where the vegetation had not been restored, erosion would be expected at a higher than normal rate.

d. Irreversible and Irretrievable Commitment of Resources

Excavation of caliche would result in the loss of some soils, including topsoils from the pit area, together with severe disturbance of nearby soils because of the movement of trucks and other excavating equipment. Soils would also be contaminated in the areas surrounding sump pits and pits used for disposal of drilling mud.

e. Relationship Between Short-term Use and Long-term Productivity

During the short-term, soil erosion would increase during the exploration construction, and production phases. Long-term

effects would be those which occur after the roads and drilling sites have been rehabilitated and would depend on the rate of success achieved during the rehabilitation process. However, over the long-term, soil contaminants would be expected to remain in the soil profile.

6. Air Quality

a. Impacts

Level 1: Air quality conditions can be and have been adversely affected by oil and gas operations, beginning with the activities involved in exploration and continuing through both development and production.

Construction of access roads and of drilling pads would introduce dust particles into the air, especially during the periods when windy conditions are present. However, the initial disturbance of these surfaces through the movement and other use of equipment during explorations, would be minor, compared to the longer-term use of these roads by the general public for hunting, fishing, rockhounding, and the use of off-road vehicles (ORVs) such as motorcycles, jeeps, and dune buggies. At present, there is no available qualitative data related to the amount of dust particles being produced in a specific area during a specific time period. Data is also needed which concerns the fallout patterns of dust particles and their effect on the surrounding environment.

While air quality is affected on a broad scale by the oil and gas industry during periods of exploration, pollution becomes much more concentrated during the developmental stages. Also, if the new oil and gas development is located on the windward side of a community, the effects of dust particles becomes more noticeable.

As oil and gas explorations progress into the developmental and exploration phases, accidents such as explosions, fires, and blowouts can affect air quality as would oil spills and leaks to a lesser degree.

Level 2: The impacts would be greater, since less control would be exerted over clearing or construction of rights-of-way, roads, or well sites. More area would be exposed and could be expected to produce more dust particles. Air quality in these areas would be lowered as a result.

b. Mitigation

Implementation of the proposed action's standard operating procedures would minimize the effect of oil and gas activity on air quality. However, even with these measures, there would be some

residual impacts. To mitigate these, access to these roads by the general public could be controlled by only allowing their use by essential vehicles. Unnecessary roads should be closed and rehabilitated.

The adverse impacts of road construction can also be minimized by limiting construction to one road for each well site. This would substantially reduce the amount of dust affecting air quality.

c. Adverse Impacts Which Cannot Be Avoided

Dust is an air pollutant. An increase in oil and gas activity would increase the amount of dust.

d. Relationship Between Short-term Use and Long-term Productivity

Short-term use would not affect long-term productivity.

e. Irreversible and Irretrievable Commitment of Resources

None.

7. Water Resources

a. Impacts

Level 1: The magnitude and scope of oil and gas activity on water resources varies. Yet, there are some general, common characteristics which cause these impacts to fall into two classes. These are: (1) degradation of water quality, and (2) reduction of water supplies.

Actions such as the building of access roads and trails, plus clearing of sites for seismic testing, stratigraphic testing, and wildcat drilling may cause surface disturbances, resulting in siltation of surface waters. In areas where unstable soils are located and the potential for natural revegetation is limited (slow), such siltation can have a long-range impact on surface water quality due to increased sediment concentrations and turbidity. Accidents such as fires, explosions, well blowouts, spills, and leaks can lead to major contaminations and to higher temperatures for surface waters when oil enters streams, ponds, or lakes.

During the production phase, the removal and handling of water from producing wells and separation facilities can cause further degradation of surface water quality. This degradation is likely to occur only if the rules and regulations specified by the U. S. Geological Survey and the Oil Conservation Commission are not adhered to, or through accidents which do occur from time to time.

Upon abandonment of a producing oilfield, those facilities which contain residual oil, brine wastes, or solid wastes may cause further water pollution. Batteries, tanks, sumps, and pipelines may deteriorate and release pollutants into adjacent surface and ground waters, if they are not properly disposed of according to regulations.

Water supplies can be lost or reduced during exploration for oil and gas. Seismic testing, stratigraphic testing, and wildcat drilling can alter the groundwater hydrology by fracturing impermeable zones below aquifers, permitting these water resources to be lost or reduced through vertical drainage. Well drilling can also require large quantities of water, especially if porous and permeable formations are encountered. Drilling of a 10,000 foot well is estimated to require about 800,000 to 1,200,000 gallons. Drillers prefer to use brine water if it is available, because it weighs more than fresh water and the extra weight is needed to help prevent blowouts. Brine water is often obtained from potash refineries in the Carlsbad area.

Injection of additional water into a producing well may become necessary during the production phase to obtain additional oil production through flooding with massive amounts of water, this water may be either fresh or produced (brackish) water. Such production techniques generally require additional water sources and deplete the availability of groundwater supplies. Some primary and secondary separation operations also utilize additional water which further reduces local water supplies. The loss of water would be critical in some areas as shown on Map 2 which shows water-sensitive areas.

Brine production fluctuates according to the amount of oil being produced. The rate of water to oil fluctuates but, in most wells, the ratio of water to oil and the rate of production of water increases with time. Thus the problem of brine disposal becomes even more serious as production time increased. The standard method of dumping brine into pits to be evaporated is questionable from the standpoint of water conservation. Unless the pits are adequately sealed to prevent seepage into the ground and unless they have enough surface area to allow removal of evaporites equal to the rate of base production and are large enough to prevent overflow, the brines will migrate to the water table and contaminate shallow aquifers. The USGS works with the state engineer on water disposal. Some of the waste water must be hauled to approved disposal sites and disposal is not allowed if a known fresh water supply is threatened. Brine disposal is covered in Notice to Lessee (NTL) 2B (See Appendix B).

An earlier review of the data regarding brine disposal in southern Lea County by Nicholson (Parker 1955, p. 626) led to the conclusion that contamination of the groundwater must be taking place. Of the pits observed in that area, none had waterproof linings and the surface areas of these pits were so small that natural evaporation of brines being discharged into them could not take place.

There were no pits which showed signs of collecting any significant levels of precipitates, indicating that effective evaporation was not taking place. In some areas where the surface is underlain with caliche, these are usually impermeable. However, instances have been reported where the caliche has been deliberately broken up to promote seepage from pits which were receiving excess brine. Based on these observations, it is evident that a considerable amount of brine must be seeping into the shallow water aquifer in Quaternary and Tertiary sediments (Parker 1955, p. 626).

Level 2: Impacts would be greater because there would be less control on new drilling locations and fewer restraints on the disposal of waste materials.

b. Mitigation

Implementation of standard operating procedures as expressed in the proposed action, would serve to minimize the effect of brine disposal on water quality. In addition, positive containment or reinjection of saline water and positive containment of caustic drilling fluids (mud), combined with proper handling, storage, and disposal of solid and liquid wastes would prevent degradation of surface and groundwater quality.

In the production phase, immediate reinjection of production water would ensure that a minimum of supplemental water would be consumed during secondary recovery operations.

c. Adverse Impacts Which Cannot Be Avoided

Level 1: Continued economic development, combined with depletion of groundwater supplies through pumping from storage, and through the loss of water supplies because of accidental contamination, are adverse impacts which would result in the water supply problem for this area becoming more and more acute. There is little evidence that additional water supplies can be found within southeastern New Mexico.

Level 2. There would be an increase in the pollution of both surface and ground water.

d. Relationship Between Short-term Use and Long-term Productivity

Level 1: In the short-term (20 to 30 years), it is anticipated that the water needs of this area will continue to increase. This anticipation is based upon the assumption that the oil and gas industry will continue to expand. A shortage of water would occur because of this expansion and would affect the availability of suitable

water for other uses, e.g.: wildlife, livestock, and supplies for human uses. However, on the plus side, there is the possibility that a new discovery of water supplies of a reliable quality and quantity could be located through test drilling for the oil and gas industry. In the long-term, the water table would be expected to become depleted, reducing it's productivity. Recharge may take years, if it occurs at all.

Level 2: In the short-term, surface and ground water would deteriorate. This deterioration would affect long-term productivity.

e. Irreversible and Irretrievable Commitments of Resources

Water supplies and water quality would be unavoidably affected in some instances.

8. Vegetation

a. Impacts

Level 1: Clearing operations to prepare soil surfaces for the construction of roads or drilling pads would cause the major impacts to vegetation in this area. These operations would be involved in exploration, development, and production of oil and gas and would include access roads, pipeline rights-of-way, drilling pads, etc. Generally there would be little or no impact to vegetation caused by seismic testing activities. In the case of aquatic vegetation, the major impacts would be caused by dislocated sediments being carried into water courses or bodies of standing water. These impacts would often be relatively minor.

Leaks, spills, and the disposal of liquid and solid wastes would be other sources of adverse impacts to both aquatic and terrestrial vegetation. The probability of toxic elements being contained in these wastes would be very high, as the probability of accidental spills or leaks increases as each additional pipeline is built.

As production in a field continues over long periods of time, pipelines, valves, and pumps become more susceptible to leaks. Also, any sulphurous or other toxic gases released into the atmosphere would cause additional damage to vegetation.

Reestablishment of the native vegetation would be hindered by the existence of abandoned roads and drill pads. Although much of the disturbed area was once covered by native shrubs and grasses, often an annual-type of cover grows back, replacing native vegetation. Further, erosion removes the natural soil cover which is then deposited in other areas because of the actions of wind and/or water. Such actions would damage or destroy both terrestrial and aquatic vegetation.

Level 2: As compliance with stipulations is reduced, more vegetation would be destroyed and less of the disturbed areas would be restored.

b. Mitigation

Implementation of the standard operating procedures as expressed in the proposed action would serve to minimize the impacts on vegetation. Liquid waste and unused gases should be disposed of in a manner which would minimize their adverse impacts. Monitoring systems should be installed to enable the operator to detect and shut down mechanical failures which could result in leaks, spills, or other destructive actions. Stipulations could be included which would require that any contaminants entering the watercourses must be contained immediately and disposed of safely.

All proposed clearing of vegetation should be confined to as small as an area as possible, to minimize impacts. During geophysical prospecting, vegetal clearing and other surface-disturbing activities should be limited to only those small areas which would be directly impacted. At other times, any area which has been cleared should be closed and reseeded as soon as the proposed use has been accomplished. Pads can be reseeded as soon as the well is in production. Strict measures should be taken upon abandonment, to ensure that the best possible rehabilitation methods have been used and that proper measures to protect the soil and vegetation have been taken.

Top soils should be retained and stockpiled, so that they can be reused as part of the area's rehabilitation would aid in it's revegetation. However, returning topsoils to an area may not suit the needs of each particular area. In many cases, the proper use of fertilizer as the top soils are being replaced, would accelerate reestablishment of vegetative cover.

c. Adverse Impacts Which Cannot Be Avoided

Both terrestrial and aquatic plants would be adversely affected by oil spills, and oil spills do occur, regardless of the measures taken to prevent them. When they occur, there will be some unavoidable damage to plant life and, sometimes to animals. Terrestrial vegetation is also damaged by operations involved in exploring for oil and gas, and by actions taken to properly abandon roads and pads, or the lack thereof.

In three types of areas, mitigation of impacts involved in the exploration, development, and production of oil and gas would be either unfeasible or simply not possible. In sand areas, caliche is used as a base for the construction of roads, drilling pads,

and support facilities for oil and gas activities and plant life will seldom return to these areas without extensive rehabilitation. Caliche pits will normally remain devoid of vegetation as long as they are in use. In limestone areas, mitigation is generally unsuccessful.

d. Relationship Between Short-term Use and Long-term Productivity

Some loss of vegetation would be inevitable in the short-term (20 to 30 years) but this impact can be offset somewhat if affected areas are carefully revegetated. In the long-term, revegetation of native plants should occur and return the land to it's original condition. However, there would probably be areas which have been affected by toxic spills which would never revegetate.

e. Irreversible and Irretrievable Commitment of Resources

Vegetative communities may never completely recover from the effects of oil and gas activity and some species may never return.

9. Wildlife

a. Impacts

Level 1: Appendix D lists the wildlife species known to inhabit the Roswell District which may be affected by oil and gas development. All factors which could benefit wildlife over either the short or long term or could adversely affect this resource, were considered in evaluating overall impacts. An assumption was made that drilling would not be undertaken in any large lake, reservoir, river, or stream; and that exploration and/or drilling activities would be prohibited within a quarter mile of river and stream channels, marshes, reservoirs, or riparian habitats.

In the exploration phase, two primary activities were considered which would have an impact on wildlife populations and habitat; these were off-road vehicles and exploratory techniques. Noise from heavy-duty exploratory vehicles and associated human involvement would adversely effect wildlife, particularly ground-nesting birds, lizards, reptiles, and burrowing animals. Seismic explorations utilize explosive thumpers and vibrators to test for oil and gas reserves. These techniques disturb wildlife by disrupting their habitat and by creating loud, sudden noises.

In the development phase, construction of roads and drilling sites, plus operation of drilling sites are the major components which will have an impact on wildlife. There are several beneficial impacts which are associated with the development and pro-

duction phases. These include an increased edge effect from roads, increased forb production resulting from additional precipitation runoff and increased numbers of perches for birds-of-prey on power lines. In the San Simon Swale area of Lea county (Map 1), oil and gas activities would not be allowed during the antelope fawning season, between April 15 and June 15. Drill sites would not be located in forb producing depressions of the swale bottom. Other site-specific beneficial impacts which have been outlined for the Lesser Prairie Chicken Habitat Area (Map 2) include protection of booming grounds and nest sites by exclusion of all drilling activities between April 1 and May 31 and the requirement that all collection pits must be covered with a fine mesh. Adverse impacts from this phase would involve disturbance caused by concentrated human activity, and by noise from vehicles and machinery.

The production phase of the oil and gas developmental process impacts wildlife more than any other operation. This phase includes the construction and maintenance of access roads, rights-of-way, and of various types of operational facilities. When evaluating impacts connected with operational facilities, such items as construction of buildings, power lines, fenced areas, pumps, separation equipment, etc., must be considered. Beneficial impacts for wildlife during this phase include, in addition to those already discussed under the developmental phase, additional niches for rodents, rabbits, reptiles and birds. In the lesser prairie chicken area, studies show that prairie chickens utilize established pipeline rights-of-way for booming grounds. All power lines constructed in conjunction with oil and gas activities must be built raptor-safe, ensuring that large raptors are protected from electrocution, particularly the golden and bald eagles. However, many of the powerlines were constructed prior to 1972, before raptor protection designs were required. Losses on these older powerlines continue. Adverse impacts associated with the production phase may be long-term and devastating to wildlife habitat. Specifically, wildlife habitat would be continually disturbed in varying degrees because of the recurring need for human activity which will be required for general maintenance operations, pipeline repair, road rehabilitation, inspection checks, and transportation of products. These disturbances would be site-specific, but a considerable loss of wildlife habitat could result, depending upon the extent of development and expansion of an oil or gas field. Wildlife populations would become more vulnerable to the hunter as access is improved with construction of oil and gas field roads. Nesting raptors are vulnerable to disturbances during all phases of oil and gas development, especially during April through August.

Oil spills and/or leaks, blowouts, and spills or leaks of caustic, salty, or polluted water are major adverse impacts. In the case of exploratory drilling, these events may take place as early as the exploratory phase but will generally be more closely associated with the development and production phases. The nature of these

impacts are several but oil spills are potentially the most severe. Contact with oil may be lethal to waterfowl, shorebirds, or other bird species when feathers become saturated, causing them to lose buoyancy and insulation. Severely coated birds may ingest oil, lose mobility, and soon die. Moist-skin animals such as amphibians, insect larvae, and various aquatic organisms suffocate when covered with an oil film. Spawning beds and rearing areas for fish may be destroyed by oil coating.

During the production phase, in addition to both direct and cumulative impacts previously discussed, brine evaporation pits containing concentrated salts and, possibly, an oil film can trap waterfowl and poison animals drinking from these pits. Oil, waste mud, and related contaminants on soil or water seriously disrupt food chains at the lowest trophic levels. Serious impacts on the aquatic habitat may be caused by tank batteries and pipelines, separation facilities, and secondary recovery operations, if oil or wastes are permitted to seep into drainages.

Two major operations of the abandonment phase were considered as the primary factors affecting wildlife. These were: abandoned facilities and reclamation. Impacts during this phase pertain to the physical presence of the facilities which have been abandoned, together with the seepage of oil and wastes from facilities which have been temporarily abandoned. These factors were considered in arriving at a final overall impact for each species. This evaluation was made under the assumption that some facilities such as pads, roads, building shells, pipelines, fences, poles, etc., would not be removed until all procedures for abandonment had been completed. The same assumption was made in dealing with reclamation. In the past, few areas were restored. The same criteria previously discussed was evaluated, with the exception that more emphasis was placed on impacts to the various species as they related to reclamation in the sense of removing unnecessary facilities and revegetating the affected area.

Implementation of proper abandonment procedures would be a beneficial impact on prairie chickens. Abandoned caliche-based well pads are favored booming ground sites and may very well affect the distribution of these chickens.

Level 2: The magnitude of detrimental impacts affecting wildlife would increase throughout the oil and gas industry's developmental processes, from the initial exploratory phase through until completion of the process of abandonment, if the Bureau of Land Management's (BLM's) standard operating procedures and stipulations as stated in the proposed action are not fully enforced. In addition to the adverse impacts identified under level 1, a broad range of both short and long-term impacts could be identified for every phase of oil and gas operations if controls are not fully enforced.

Those species which are strongly related to water, or near water, and riparian habitats would be most affected by oil and gas operations. Habitats of these types are primarily confined to lakes, ponds, springs, the Pecos River floodplain, the Canadian River floodplain, portions of the Black River, and the floodplains of perennial, seasonally live or spring-fed streams. Although these areas comprise only a small percentage of the total surface area, they support and are vital to a large percentage of those species found within the district. These areas serve as major migration routes, wintering areas, nesting areas, and yearlong habitat for numerous song birds, shore and wading birds, waterfowl, and raptors. They also support a variety of mammals, reptiles, and amphibians.

Due to the relatively narrow width or small size of these areas, the construction of roads and facilities would cause a substantial reduction in wildlife habitat. This reduction combined with the potential of erosion siltation, and the possibility of oil leaks, spills, or blowouts would result in adverse effects for most all species related to the habitat. The degree of adversity would depend on the animal's association with the habitat. Fish, aquatic species of amphibians and reptiles, waterfowl, and both shore and wading birds would be affected in the highest degree.

Oil and gas operations would have various effects on birds of prey. Some beneficial impacts for ferruginous hawks, redtailed hawks, turkey vultures, and other buteos and vultures which prefer open areas could be increased perches, increased rodent populations, decreased ground cover, and road kills. Goshawks, sharp-shinned hawks, alpomado falcons, and other members of the Accipiter and falcon families which prefer forested or extensive brushy areas would be adversely impacted because of habitat losses.

In the eastern two-thirds of the district, high bluffs and ridges are the primary nesting habitat for most large birds of prey. Bluffs and cliffs near the rolling or plains area are particularly important. Activities within, or in close association with, these areas could adversely affect raptors during the nesting seasons.

The effect of oil and gas activities on prairie chicken habitat and populations would be extremely difficult to determine. There is little doubt that petroleum oil and gas activities would have some adverse effects on prairie chickens but there is no actual information to document these effects. However, as noted under level 1, there are some beneficial impacts affecting prairie chickens.

Loss of habitat to road and pad construction is obvious, however, the magnitude of the detrimental effect is not certain. Powerline construction accompanying these activities presents a hazard

to roosting birds. Losses of this type have been documented, but again, the magnitude of these losses has not been determined. Pits for collecting waste hydrocarbons also present a problem. A number of dead prairie chickens have been found in these pits. Preliminary investigations indicate that many birds and small mammals die in these pits every year.

In prairie chicken areas, noise from drilling rigs and gas or diesel engine-operated pumps during the breeding season is considered to be detrimental to breeding activities. The noise interferes with the ability of the females to hear the booming by the males which attract them to the breeding or "booming" grounds. Development of roads or well sites on these booming grounds causes the abandonment of the area by the prairie chickens.

Pronghorn antelope are adversely impacted through the loss of habitat because human intrusion often prevents them from occupying an area. Such intrusion can have a serious impact if it occurs at a critical time and place. A prime example is the San Simon Swale southwest of Eunice which is a critical forb-producing area for antelope. In general, these areas are located in large swales and playas which tend to collect and hold moisture. Due to the fluctuating climatic factors in the district, these areas are extremely important in maintaining antelope populations, because they provide a more dependable source of forbs. During years of overall poor forb production, antelope will concentrate in the areas. Drilling operations, construction, and other human activities which would curtail the use of these areas would be very detrimental to antelope populations. The loss of portions of these forb-producing areas to facilitate road and pad construction would also result in a severe adverse impact. Another impact which would be adverse to wildlife is the release of poisonous hydrogen sulfide gas. This gas is known to cause wildlife mortalities, but no estimate has been made of the extent of this problem.

b. Mitigation

It is very important that oil be prevented from polluting natural drainages. Disturbances and contamination caused by oil and gas activity must be limited to the smallest area possible for the operation. Oil-coated or killed vegetation can be removed and replaced.

Mitigation of impacts concerning loss of mobility, due to pipelines; and disturbance, due to human activity; are necessary. If the physical barrier of installations will be significant, such as barring access to drinking water, this problem should be recognized in advance and construction modified or mitigated to avoid the problem. Disturbance due to noise and human occupation of the area may be short-term, for example, during the construction phase. This disturbance can be confined to small areas and located to minimize the problem. Consultation with a field biologist during the development phase, is recommended.

The mitigation of environmental impacts, as they affect animal life, would be largely one of degree rather than of new or different procedures. Rehabilitation by seeding or planting is more difficult under semiarid conditions because fewer plant species are adapted for life in this environment. The chances of success are much less due to several factors, principally inadequate or unpredictable moisture. Oil-coated plants are not easily replaced because of these problems. Replenishment of depleted water supplies would appear to be more difficult to achieve under semiarid conditions.

c. Adverse Impacts Which Cannot Be Avoided

Wildlife disturbances caused by exploratory activities cannot be avoided. General inspection and maintenance of oil and gas facilities are standard operating procedures in this industry, although these activities cause local, short-term disturbances of wildlife.

d. Relationship Between Short-term Use and Long-term Productivity

Due to the semiarid environment of the upper and lower Sonoran life zones, impacts affecting wildlife habitat and food supplies which might be short-term and reasonably easy to mitigate in wetter areas, could easily become long-term here. An example would be vegetation removed during the clearing of rights-of-way for construction of trails or roads. This impact to vegetation would be magnified by the scarcity of water which would delay revegetation of the cleared area. The drawdown of standing water and it's effect on wildlife habitat would also be acute but short-term. However, the high viscosity and stickiness of crude oil may have serious impacts on wildlife over the long-term, if this oil drains continually from oil-saturated soil into watercourses which supply water for wildlife. The effect of this oil seepage on both the soil and aquatic organisms would be long-term. Aquatic species are particularly susceptible to even small amounts of oil entering their environment.

Leaks or spills of oil, caustic fluids, or salt water could saturate soils and flow or seep into drainages, killing vegetation. Natural drainages are often an important habitat for most species. Oil and/or salty water being discharged into drainages would destroy both food and cover for wildlife, sterilizing the soil for a short time and polluting the water. Oil, sediments, and excessive amounts of dissolved salts entering streams or other bodies of water can directly lower the quality of fish habitat and directly or indirectly lower fish reproduction for a short time. The most desirable fish are usually the least tolerant to such pollution. However, except in the worst cases, this impact would gradually lessen with time and the habitat should eventually recover.

Burrowing mammals, ground nesting birds, and reptiles, particularly those favoring climax vegetation or of a particular successional stage, would be moderately-to-heavily impacted over the long-term, due to a loss of habitat. The short-term loss would be caused by the loss of individual animals. Examples of these losses would be prairie dogs, burrowing owls, lesser prairie chickens, and the Great Plains toad, all of which could be killed by the seepage of pollutants into their water supply.

e. Irreversible and Irretrievable Commitment of Resources

None.

10. Threatened or Endangered Plants or Animals

Site-specific measures must be taken for each action to protect threatened or endangered plants or animals. Such measures will be the result of a site-specific survey as allowed by standard operating procedures (supplement to Form 3109-3). Standard or special stipulations will be included in any grant, thus assuring protection of those species.

11. Recreation

a. Impacts

Level 1; The quality of most recreational resources in local areas of the public lands, such as the Mescalero Sands and recorded caves, would be protected or enhanced under the proposed action. Extensive recreational uses which depend on the use of motorized vehicles for access, will benefit from the development of additional roads in support of the oil and gas industries but this benefit would be removed when drilling sites are abandoned, if roads supporting these drilling sites are also abandoned. These impacts would have a minor effect, since most areas of the public land would continue to be accessible because of roads which have been constructed in support of other resource values such as grazing. Impacts identified for wildlife would have the same type and degree of effect upon associated recreational activities which include hunting, fishing, and wildlife observation.

Although there are standard operating procedures to regulate drilling operations in cave areas, there is a strong possibility that unrecorded caves could be impaired by drilling operations. Also, due to subsurface magnetic effects which prevent an accurate plotting of the surface/ subsurface alignment of known caves, there is a possibility that drilling could impact these resources. As a result, cave formations could be broken, drilling fluids could be lost as new caves are encountered, drainage or infiltration patterns of surface water could be changed, and cave plants or animals could be destroyed. On the other hand, the discovery of new caves could be a beneficial impact to the recreational resource.

Seismic exploration is regulated by minimum standards (Form 3040-1) on leased and unleased lands under the proposed action. However, seismic activity atop caves which are within 100 feet of the ground surface, could cause breakage of fragile formations or could cause passages to collapse.

Level 2: Impacts would be similar to level 1, but would be more adverse, depending upon the degree of noncompliance with the standard operating procedures.

b. Mitigation

Impacts which would occur if access roads were abandoned when production in an oil or gas field ends, could be mitigated by allowing access roads to remain open and maintaining them for public use.

Mitigating measures described in the "Wildlife" portion of this environmental assessment would enhance associated recreational uses.

Unknown caves which have natural surface entrances could be located by using infrared detection devices during an aerial survey. Also, the location of passageways in caves could be accurately determined through the use of electronic equipment. Such actions could, in turn, avert many potential impacts.

Seismic exploration could be regulated by adopting stipulations similar to the standard operating procedures which are used for drilling operations. Such stipulations could regulate such explorations within specified distances from known caves, their passageways or cave-bearing formations.

c. Adverse Impacts Which Cannot Be Avoided

Because the present level of inventory technology is not adequate to detect caves which do not have surface entrances, impacts to these caves cannot be avoided prior to seismic explorations or drilling activities.

d. Relationship Between Short-term Use and Long-term Productivity

The short-term use of public lands (20 to 30 years) is expected to result in a slight increase in the long-term productivity of recreational uses. However, negative impacts to fragile cave resources would cause a minor reduction in productivity, in terms of visitor appreciation.

e. Irreversible and Irretrievable Commitment of Resources

Any destruction of cave resources would constitute an irreversible and irretrievable commitment of these resource values.

12. Wilderness

a. Impacts

Level 1: Regulation of mineral leasing and associated development activities in accordance with the Wilderness Protection Stipulation and Interim Management Policy (IMP) would protect wilderness values in most lands under wilderness review. One exception, which was specified by Congress, is that physical impacts created by exploration or development which occurred prior to the legislated BLM wilderness review on October 21, 1976, would continue in the same manner and degree on those lands. Manner and degree have been interpreted in Bureau policy to allow for logical pace and progression of drilling activities. Physical impacts which began on lands outside the boundary of wilderness review areas may progress to areas inside the boundary. This legislative requirement and policy allows for possible impairment of all wilderness values (such as size, naturalness, solitude, etc.) Mineral development impacts of this type can only be regulated to insure that manner and degree of activities do not change, and that unnecessary or undue degradation of public lands does not occur. It is assumed that under the worst case, less than 10 percent of the lands under wilderness review would be impaired due to continuing pre-1976 impacts. The actual extent of affected lands cannot be determined at this time since drilling permits are processed on a site-specific basis and impacts would be determined at that time.

Level 2: The wilderness review process, nonimpairment policy, and continuation of activities for the development of minerals are legislatively required and would, therefore apply to this alternative. Actions considered under this alternative are the same as for the proposed action and will not be discussed further.

b. Mitigation

Adverse impacts to wilderness values could only be mitigated by a change in legislation that would allow regulation of all mineral leasing activities to prevent resource impairment.

c. Adverse Impacts Which Cannot Be Avoided

Impairment of wilderness values, which could be caused by expanding physical impacts allowed under the "manner and degree" concept, cannot be avoided.

d. Relationship Between Short-term Use and Long-term Productivity

Short-term use of oil and gas resources throughout the production phase (20-30 years) would impair the long-term productivity (naturalness) of potential wilderness areas.

e. Irreversible and Irretrievable Commitment of Resources

Impaired wilderness values may not be restored by the time wilderness study decisions (1985 through 1988) are made for this district. Natural restoration and rehabilitation of disturbed areas following abandonment of oil and gas facilities could erase physical impacts at some future date. Restored areas could be considered for wilderness review if Congress legislates such an action, and resources would not be committed. Also, the standards for acceptable impacts in designated wilderness areas could be changed and no resource commitment would be made.

13. Cultural Resources

a. Impacts

Level 1: The illegal collection of artifacts would increase as access to areas containing cultural resource sites was improved during the proposed action's production phase. Additionally, the pothunting problem would be worsened because of the additional workers brought into these areas during the different phases of minerals activity.

While these impacts would be area wide, they would be most severe in those areas where access had been limited prior to the beginning of minerals activity. Areas where access has been limited include the area northwest of Roswell, and the Guadalupe mountains. Because of the steep terrain and the roughness of existing access routes, caves and midden rings within the Guadalupe mountains have been somewhat protected from pothunters. These caves are an attractive source of artifacts because they preserve and protect fragile items.

As stated in Chapter 2, much of the information about a site is contained in the depositional contact. Therefore, an undisturbed site is more valuable to the archeologist. Displacement of artifacts, or the removal of a portion of a site destroys much of the information about the site.

Four major oil and gas activities have the potential of producing the impacts described above. These are: (1) Pipelines which are laid on the surface without an archeological clearance being completed, (2) The use of equipment and vehicles to maintain an electrical line spanning an archeological site. These vehicles could drive across the site during maintenance work, (3) New tracks are often created by vehicular traffic during adverse weather, adversely impacting cultural resource sites, and (4) Seismic explorations can severely impact cultural resources since their lines are not surveyed for the presence of these resources prior to exploration. Seismic thumpers can also affect the placement of artifacts.

Another major impact to cultural resources could occur during emergency field conditions such as well fires. Sites could be greatly disturbed or destroyed in the process of fighting such fires, especially if the well pad site had previously been relocated to avoid a nearby site containing archeological artifacts.

If a well fire were to get out of control and burn a site, the thermoluminescence dating of pottery would be changed. Radio-carbon dating would also be affected.

Oil spills or leaks would also interfere with the interpretation of a site. Not only would the oil hamper special studies such as radiocarbon dating and pollen analyses, but it would also affect the analysis of the artifacts themselves. For example, ceramics are made of porous materials and would be likely to absorb the oil. This would confuse identification of the ceramic type and probably interfere with the temper analysis.

These impacts would be most likely to occur where a tank battery location had been moved to avoid a cultural resource site. They could also occur within areas which had been developed prior to implementation of requirements for cultural resource clearances.

Level 2: In addition to the sources of impacts described for level 1, there would be other impacts caused by the creation of unauthorized facilities such as: Rights-of-way, roads, drilling pads, or the unauthorized expansion of such facilities as had been properly agreed upon. The "blading," or cleaning of seismic lines by a bulldozer, would also be as adverse impact, unless an archeological clearance had been completed. In any case, any of the unauthorized actions described above could partially or totally destroy cultural resource sites.

b. Mitigation

A strong law enforcement program, plus daily patrols, would help to reduce the amount of pothunting.

c. Adverse Impacts Which Cannot Be Avoided

If the proposed action is implemented, the adverse effects of pothunting cannot be avoided. Even a strong law enforcement program and daily patrols would only reduce, but not eliminate, pothunting. Other adverse conditions which cannot be mitigated include disturbances to cultural resources caused by seismic explorations, road expansion during adverse weather conditions, and contamination of cultural resources which would result from well fires and oil spills.

d. Relationship Between Short-term Use and Long-term Productivity

Archeological and historical sites are a nonrenewable resource. Once a site has been destroyed, another site of that time period cannot be created, sites which are destroyed or altered as a result of implementing the proposed action would remain in that condition. In effect, the cultural resource data base would be diminished.

e. Irreversible and Irretrievable Commitment of Resources

Once an artifact has been removed from its proper position in a site, or destroyed, its value for historical significance is diminished. As the proposed action is implemented, public access would be improved and the damage caused by artifacts being collected and sites being destroyed would increase.

14. Visual Resources

a. Impacts

Level 1: The visual impacts that activities involved in expansion of the oil and gas industries would have on a characteristic landscape can be determined through use of the contrast rating process which is described in BLM manual, Section 8431. This rating numerically describes impacts that an activity would have upon the basic elements of form, line, color, or texture which may be present in different landscape features of land surface, vegetation, or existing structure. In compiling this rating, these basic elements are listed in the descending order of noticeability. This contrast rating indicates both the severity of a possible impact and serves as a guide to identify measures which would reduce an impact.

The significance of impacts can be evaluated by comparing rating scores with (30 being the maximum possible score) minimum standards for one of five possible Visual Resource Management (VRM) classes, or an Area of Critical Environmental Concern (ACEC) for scenic values. These standards are:

Class I. The degree of contrast for any one element may not exceed a weak degree of contrast (1x) and the total contrast rating for any feature may not exceed 10;

Area of Critical Environmental Concern for Scenic Values. The degree of contrast for any one element should not exceed a moderate value (2x), and the total contrast rating for any feature may not exceed 10;

Class II. The degree of contrast for any one element should not exceed a moderate value (2x), and the total contrast rating for any feature may not exceed 12;

Class III. The degree of contrast for any one element should not exceed a moderate value (2x), and the total contrast rating for any feature may not exceed 16;

Class IV. The total contrast rating for any feature should not exceed 20;

Class V. An interim classification for rehabilitation of an area. Based upon its indicated potential visual resource management class (I, II, III, or IV), it must meet the appropriate degree of contrast of selected class.

Bureau of Land Management (BLM) policy states that contrasts which exceed the allowable limits for a VRM class are "Significant Adverse Impacts."

Within a physiographic province, the VRM class assigned to a particular land area is dependent upon physical attributes of scenic quality and visibility which are combined with the social attribute of viewer sensitivity towards modification of the landscape. Interim VRM classifications are based only on these attributes of the visual resource, while final classifications are either established or modified by managerial decision as part of the land use planning process.

The final VRM classification may be different than the interim category. For example, Class III areas may be upgraded by managerial decision to Class II so that a nearby Class I area can be protected. Conversely, an interim classification can be downgraded to accommodate large-scale activities, such as strip-mines, which would seriously disturb the surface.

Visual resources in the Roswell District would be impacted during all phases of oil and gas development although adverse impacts would be incurred primarily during such surface-disturbing phases as exploration and production. These impacts would be reduced following completion of the abandonment phase with disturbances becoming less noticeable as natural restoration (revegetation, etc.) progressed.

Visual contrast scores would probably vary from 4 through 27 in this district, with an average score of 15, depending on the landscape character, extent of disturbance, types of production facilities, and the location of an area's critical viewpoints. Compliance with those standard operating procedures related to painting and/or relocation of drilling sites to obtain visual screening, would reduce visual contrasts resulting from implementation of the proposed action, to insignificance. Adverse impacts would be greatest in areas which have not been previously altered by man's activities, plus rocky areas where reclamation efforts would produce only minimal results and in areas where structures used by the oil and gas industries would not be compatible with other structures which are already in place.

Level 2: An increase in visual impacts would result from a lack of compliance with painting or other visual resource management stipulations.

b. Mitigation

Since visual contrasts caused by oil and gas development may affect all basic elements of the visual resource, mitigation should be undertaken in the order of noticeability of those elements, e.g.: form, line, color, and texture. Structures or surface disturbances could be modified or changed in their orientation to minimize their impacts to landform, vegetation, or existing structures.

Impacts to form and line elements could be mitigated in areas with pronounced topographic variations by modifying structures so that they repeat elements in the natural landscape, or simulate existing structures such as windmills, etc. Structures could also be positioned so that they are not located on the visual horizon, or low profile structures could be used. Modifications of this type should be applied primarily in naturalistic landscapes which were not previously impacted by the development of oil fields, or in special areas such as VRM classes I and/or II, plus Areas of Critical Environmental Concern which are so-rated because of their scenic values.

One standard operating procedure which is used to reduce color contrasts, is to paint structures with either of two neutral colors. Should a broader range of colors be developed for use in a

wider range of landscapes, the impacts of contrasting colors would be reduced even more. In this case, the most appropriate color could be specified for use as part of the stipulations for each specific drilling site.

On level prairies where facilities cannot be screened from view by natural terrain features, new facilities in existing oil fields, and facilities in the "visual corridor" along major travel routes, stipulations concerning the proper use of painting are the primary method for reducing visual contrasts. This also applies to the repainting of existing facilities and for developments on lands where federal mineral rights have been reserved.

Impacts to texture could be partially mitigated by the proper placement of drilling pads to avoid exposing large areas which are devoid of vegetation to public view. Camouflage painting could be required in special cases to minimize the textural contrasts of smooth structures with the irregular texture of adjacent vegetation.

The long-term impacts on visual resources which are caused by the development of oil and gas fields would be minimized by implementing those standard operating procedures included in the proposed action. Visual contrasts could be reduced to negligible conditions, if restoration of the land surface to its natural contours or to a reasonable approximation, and successful restoration of natural vegetation was required as a condition of the lease.

c. Adverse Impacts Which Cannot Be Avoided

Level 1: During the production phase, visual impacts would occur at reduced levels but would still be present even if all standard operating procedures and feasible mitigation measures were successfully applied. Impacts would be reduced to an insignificant level if proper measures for rehabilitation and restoration are made during the abandonment phase.

Level 2: Visual contrasts resulting from noncompliance with standard operating procedures would have a cumulative effect on landscape character, and would probably result in intensively developed areas being relegated to VRM Class V status. Areas which lack oil and gas deposits would suffer less adverse impacts and those intrusions which did occur would not be severe enough to warrant a change in their VRM classification.

d. Relationship Between Short-term Use and Long-term Productivity

Level 1: Short-term use during both exploration and production phases would affect visual resources, but impacts would be at acceptable levels. The long-term quality of visual resources would be restored, following completion of the abandonment phase.

Level 2: Both the short-term use and long-term productivity of this district's visual resources would be affected more severely. Visual impacts would be greater than acceptable levels and resources would be committed and would remain at less than optimum condition for a longer period of time under this alternative and would remain impaired until surface disturbances ceased and the forces of natural restoration erased the damage.

e. Irreversible and Irretrievable Commitment of Resources

None.

15. Economic and Social Resources

a. Economic Impacts

Implementation of the proposed action would cause a number of economic impacts in southeastern New Mexico as the oil and gas and associated industries expand. Over the next 20 years, economic changes would result in an expanded, stable economy, with Chaves, Eddy, Lea, and Roosevelt Counties being most affected. Curry and some other counties could also be included as these industries expand into their areas. Several new pipelines and refineries would be expected to be constructed and would become economic assets for southeastern New Mexico.

However, there are impacts which might be negative, if care is not taken to ensure mitigation. These are: losses caused by continuing oil and gas activities during calving and lambing seasons and forage losses resulting from removal of vegetation as the number of drilling pads is increased, plus their supporting roads and other facilities. Livestock are also killed when they drink toxic fluids from improperly fenced sump pits. Deaths are also caused when livestock collide with vehicles or equipment or become entangled in equipment.

b. Mitigation

The impacts caused by the proposed action could be mitigated by limiting oil and gas activities during lambing and calving seasons. While such protection would cause some disruptions in the oil and gas industries, those losses would be offset to some degree by

maintaining the size of herds and flocks, plus the improved public image of those industries. Losses in forage which would be caused by construction of drilling pads and support roads, would be partially mitigated by an increase in the availability of employment opportunities in those industries. While ranchers do not receive direct payment for forage losses and other disruptions caused by oil and gas activity on federal grazing permits or lease areas, they usually benefit from employment opportunities for themselves and their families. Ranchers also are paid for damages to their property and for rights-of-way across private lands.

Proper planning and the exercise of caution in locating oil and gas operations to minimize disturbances to livestock and wildlife are keys to the mitigation of unfavorable impacts and to enhancement of this area's total environment. The use of sound environmental procedures during construction, and prompt rehabilitation of roads and drilling sites when they are no longer required, would mitigate a large percentage of the impacts which occur.

Detailed measures for mitigation of impacts discussed are presented as standard stipulations in the standard operating procedures portion of the proposed action.

c. Adverse Impacts Which Cannot Be Avoided

There would be some losses to the potash industry and a reduction in available forage which cannot be avoided if the proposed action is implemented.

d. Relationship Between Short-term and Long-term Productivity

Implementation of the proposed action would increase the short-term use levels of the oil and gas resource and would possibly reduce long-term productivity, if new sources were not located. This would result in a loss in area employment and a reduced quality of life in the area. There would also be some losses to both the oil and gas, potash, and agribusiness industries caused by conflicts in use requirements for resource areas.

e. Irreversible and Irretrievable Commitment of Resources

Extraction of oil and gas is both an irreversible and irretrievable commitment of resources which will affect the long-term economy of this area under the proposed action.

a. Social Impacts

Social impacts of implementing the proposed action would vary, depending on the orientation of the individual or group

affected. In the urban areas, and to some extent in the farming/ranching community, social impacts would be favorable because of the increase in job availability. There would be some disruption of historical management practices on ranches and of the "ranch lifestyle". However, these disruptions would be difficult to assess because the impacts upon these families would be based on value judgements rather than being quantitative.

b. Mitigation

The only possible mitigation of these impacts would be through education and public relations efforts to assure that the individuals and groups affected understand actions to be taken under the proposed action. Also, every effort could be made by the oil and gas industries to employ local people so that the socioeconomic benefits were felt in the communities affected.

c. Adverse Impacts Which Cannot Be Avoided

There would be some loss in the quality of ranch lifestyles.



CHAPTER 4
CONSULTATION
AND
COORDINATION



Chapter 4

CONSULTATION AND COORDINATION

The environmental assessment team was formed in March, 1980. Team members were Bureau of Land Management (BLM) professionals who were assigned to the Roswell District Office or the Carlsbad Resource Area office. These professionals furnished expertise in vegetation, air quality, soils, hydrology, wildlife, cultural resources, visual resources, wilderness, recreation, watershed, minerals, geology, and editing. Team members were chosen for their knowledge of the Roswell District.

During the preparation of the draft environmental assessment, the team was in contact with other federal offices, state and local agencies, interest groups, and individuals. Communication varied from formal, written comments, to informal personal contact.

When the draft assessment was completed in August 1980, approximately 55 copies were distributed to various federal, state, (via the State clearing house) and local governmental entities. Individuals, commercial interests, and conservation groups were also sent copies. News releases were printed in news media serving the district, informing interested persons of the availability of the document. Copies were made available to local libraries as well as appropriate libraries in Albuquerque, New Mexico and Odessa, Midland, and Lubbock, Texas.

Twelve (12) letters were received from 10 respondents containing approximately fifty (50) substantive comments. Table 4-1 lists each letter and its assigned number and which environmental concerns were addressed.

The team carefully considered all comments as well as suggested changes by the BLM's state office in development of this final document.

The following section contains copies of all letters received. Comments are keyed to the control number of the letter in which they appeared (comment 1-3 is the third comment in letter No. 1). The responses to specific comments follow the appropriate comment letter. In some cases, responses go beyond the scope of the specific comment, in order to adequately cover other related comments and to maximize the cross referencing of responses.

The preliminary final document was routed to the U.S. Geological Survey (USGS) and to BLM's New Mexico State Office for review. Informal comments were received and incorporated into the final document.

TABLE 4 - 1
INDEX OF PUBLIC COMMENTS

Letter No.	RESPONDENT	No. Response Needed	Editorial	Assessment Procedures	Administration Procedures	Mitigation Measures	Glossary	Alternatives	Topography	Geology	Air Quality	Water Resources	Vegetation	Wildlife	Threatened & Endangered Species	Recreation	Wilderness	Cultural Resources	Visual Resources	Socio-Economics
1.	United States Geological Survey			X	X		X			X							X		X	X
2.	United States Fish and Wildlife Service			X	X	X						X	X	X					X	X
3.	United States National Park Service				X															
*4.	New Mexico State Planning Division	X																		
5.	New Mexico State Natural Resources Department			X								X	X	X						
6.	New Mexico State Engineer	X																		
*7.	New Mexico State Historic Preservation Officer																	X		
8.	Eastern Plains Council of Governments						X				X									
9.	National Wildlife Federation					X	X				X									
10.	New Mexico Wildlife Federation					X					X	X		X	X					X

* In each instance, there were two letters received.



United States Department of the Interior

CHAMBERLAIN SHUFFY
P. O. Drawer 1857
Roswell, New Mexico 88201

September 26, 1980

Memorandum

To: District Manager, Roswell

From: District Oil and Gas Supervisor, Roswell

Subject: Draft Environmental Assessment (EA) NW 060-80-071 prepared by the Bureau of Land Management, Roswell District, for oil and gas leasing in Southeast New Mexico

The draft EA has been reviewed and the following is a list of our comments which we recommend be incorporated in the subject draft:

- 1-7
1-3
1-2
1-3
1-4
1-5
1-6
1-7
1-8
1. Page 1-5, line 7: USGS will not prepare Environmental Assessments for every action. EA's will be prepared for actions not categorically excluded and for actions found to be excepted from exclusion as a result of Categorical Exclusion Review.
 2. Page 1-5, last sentence: BLM does not authorize access roads and well pads constructed on lease. USGS is the authorizing agency for all on-lease oil and gas activities.
 3. Page 1-14, section h: USGS will permit activities during wet or muddy conditions if significant emergencies develop. Such emergencies could include blowouts, fires, or other life threatening events.
 4. Page 1-14, section i: The statement that all permanent facilities would require painting is not correct. Procedures initiated by BLM and USGS in June 1978 require that only facilities of certain size and visibility would be painted to minimize visual impact.
 5. Page 2-6, first sentence: The date given for first petroleum production in Southeast New Mexico is grossly in error. Oil and gas was first discovered in the 1920's with extensive development in the 1930's.
 6. Page 2-49, first sentence: The sentence abbreviates million cubic feet as (MCF). The correct abbreviation is MMCF.
 7. Page 3-5, first paragraph: Minor impact if any due to small drill hole size and State spacing requirements.
 8. Page 3-6, first paragraph: Remote possibility because of carbonate rock.

Response 1-1

The text has been revised to clarify this point.

Response 1-2

The text has been revised to clarify this point.

Response 1-3

The discussion has been revised to note the emergency exceptions. The discussion has been moved from chapter 1 to appendix A.

Response 1-4

The discussion has been revised to better explain which facilities would require painting. The discussion has been moved from Chapter 1 to appendix A. Appendix A-1 is a copy of the present painting policy.

Response 1-5

The date given in the draft assessment was a typographical error which has been corrected.

Response 1-6

The text has been corrected.

Response 1-7

The text has been modified.

Response 1-8

The text has been revised to clarify the severity of the possible impact.

1-9 9. Page 3-26, third paragraph: Should include NTL-2B and USGS requirements which when met will cover lined pits, unlined pits and salt water disposal systems. Also that ground water is not a factor in certain areas in eastern Eddy County.

1-10 10. Page 3-45, last paragraph: Should be stated as waste hydrocarbons.

1-11 11. Page 3-51, Wilderness (1) Impacts: There may be impacts due to development in Wilderness areas due to "Grandfathering" as discussed in 11(A)(1).

1-11 Also it should be mentioned that areas of "Wilderness" or other sensitive areas should not be leased. If a lease expires in a sensitive area it should not be re-issued.

Logical progression for drilling should be mentioned.

1-12 12. Page 3-66, last paragraph: Potash resources are protected by the Secretary of the Interior's oil-potash area of 11/5/75 and by the New Mexico Oil Conservation Commission's R-111 area. All drilling within the Secretary's oil-potash area must meet USGS oil-potash stipulations and have the approval of the District Mining Supervisor. This will probably result in no significant loss of potash.

1-13 13. Page 3-30, last paragraph: The paragraph states that a BLM "specialist" may shut down a mechanical failure. The type specialist involved should be identified in the EA as a person qualified to do such an act.

1-14 14. Glossary, "Abandonment": The definition for abandonment states that the permit to drill is a joint USGS/BLM permit. This is not true. Form 9-331c, Application for Permit to Drill, is a USGS permit form, approved by an authorized official of USGS.

Jerry W. Long
 Jerry W. Long
 District Supervisor

Response 1-9

NTL-2B (Notice to Lessee) has been attached as appendix B and is referenced in the text.

Response 1-10

The text has been modified.

Response 1-11

The wilderness discussion has been expanded to cover the suggested points.

Response 1-12

The text has been modified to qualify the magnitude of conflict.

Response 1-13

The discussion regarding BLM specialists involvement in shut down of mechanical failures has been deleted.

Response 1-14

The Glossary has been revised to clarify this point.



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Field Supervisor
Ecological Services, USFWS
Suite C, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

2

September 16, 1980

Memorandum

To: District Manager, Bureau of Land Management
Roswell District Office, Roswell, New Mexico

From: Acting Field Supervisor, FWS, Ecological Services,
Albuquerque, New Mexico

Subject: Review of draft programmatic environmental assessment Oil
and Gas Leasing Roswell District, Southeastern, New Mexico
(District Manager O'Connor's August 13, 1980 letter)

We have reviewed the subject document and have the following general and specific comments to submit for your consideration.

General Comments:

201 The purpose of the subject draft assessment is not clearly presented. The copy provided to us did not have a page 1-1, thus this information may have been presented. If significant impacts or concerns are addressed in the assessment review process, does the BLM plan to prepare a draft environmental impact statement?

202 We understand that the draft assessment addresses various programmatic alternatives. The procedure of issuing specific oil and gas leases is not clearly understood. Our area of concern, fish and wildlife resources, often requires site specific evaluations to determine habitat values and potential effects. This is especially pertinent to potential impacts to threatened or endangered species. Some assurances should be made that oil and gas leases will be individually reviewed for fish and wildlife resource impacts (including endangered species) and if necessary the New Mexico Department of Game and Fish and the U.S. Fish and Wildlife Service will be coordinated with to include agency concerns prior to decisions.

Response 2-1

The draft has been revised to more clearly state the purpose of the document.

The BLM does not plan to prepare a draft EIS because the impacts identified in the assessment and through public comment can be sufficiently mitigated. One possible exception to this may involve pollution of ground water from water injection. However, the BLM only has authority over surface activities. While the assessment mentions hazards, all "down-hole" monitoring and regulation is the responsibility of the United States Geological Survey (USGS). To attempt to analyze these impacts would go beyond the scope of this assessment. BLM has no control over that segment of the problem and, therefore cannot mitigate or otherwise correct the problem.

Response 2-2

The BLM is aware of Sec. 7 consultation requirements for all actions which may affect threatened or endangered species or their habitat. Site specific assessments are performed as supplements to habitat programmatic assessment. The text has been expanded to better show the relationship between the programmatic assessment and individual actions.

The BLM has the responsibility to comply with the Endangered Species Act of 1973, the Inter-Agency Cooperation Regulations (January 4, 1978; 43 FR 870-876) and the 1978 Act amendments. It is the responsibility of the Federal agency effecting an action to determine whether the proposed actions will or may affect federally listed threatened or endangered species or their habitat. If the Federal agency determines the action will or may affect listed species or their habitat, that agency shall convey a written request for formal Section 7 consultation to the Regional Director, U. S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, New Mexico 87103.

The FWS and Environmental Protection Agency, in cooperation with the New Mexico State EID and the BLM, have recently conducted field surveys of Southeastern New Mexico to determine the extent of wildlife losses and other problems associated with oil and gas waste pits. It was determined that waste pits may impose a hazard to waterfowl, shorebirds, passerine birds, raptors, small mammals and possibly reptiles and amphibians. The significance of these concerns and possible mitigative measures should be discussed in the draft assessment.

Response 2-3

The text has been revised to better present this problem.

Response 2-4

The draft mentioned Roswell Districts' role in Texas only as an information item. The text has been revised to explain the limited extent to which this assessment affects Texas.

Specific Comments:

Page 1-2, I. Introduction and Background: Mention is made that the Roswell District also administers all federally owned mineral resources in Texas. The draft assessment does not appear to address gas and oil leases in Texas. If the Texas leases are included then portions of the draft would require expansion to cover Texas habitats and fish and wildlife resources.

Page 1-4, I. b. Leasing: In the event sensitive environmental resources (fish or wildlife resources or their habitats) are found to exist in a potential leasing site, it is requested that the New Mexico Department of Game and Fish and FWS be notified and given an opportunity to provide comments. In addition, the requirements of the Endangered Species Act and specifically Section 7 regulations must be met if there is potential for an endangered species to be impacted.

Page 1-9, I. c. Leasing, pages 3-36 and 3-44 Wildlife Impacts: Mitigation of possible impacts to prairie chickens and or their habitats appear to be adequately discussed. The use of fine mesh netting or buried holding

Response 2-5

The Roswell District, BLM, maintains constant dialogue with the New Mexico Department of Game and Fish and will continue to consult with them about sensitive wildlife issues. In addition, FWS will be contacted as requested. See also Response 2-2.

Response 2-6

This recommendation is included in the revised standard operating procedures which include the use of fine mesh netting for all permanent pits.

tanks should be considered for all waste pits where waterfowl, shorebirds, passerine birds or small mammals may also be impacted.

Page 1-29, C. Monitoring: The foresite of BLM to monitor oil and gas activities in an effort to meet the six goals is appreciated. Impact predictions, discovery of unanticipated or un-predicted effects and additional mitigation needs are important aspects of monitoring.

Response 2-7

Page 1-31, D. Proposed Standard Operating Procedures: It is unclear if these procedures are to be implemented in the future or if the draft assessment is addressing them for possible consideration. We wish to endorse those measures discussed in D.1. and urge the BLM to implement them on all oil and gas leases including those currently in effect.

The introduction to these procedures in appendix A has been expanded to explain the purpose of the proposed standard operating procedures. Also, see Response 2-6.

Response 2-8

Page 2-16, B. a. Aquatic Plants: Aquatic resources and vegetation of importance also occur in the McMillan Delta and Avalon Lake areas. These areas are important as habitat for a diversity of wildlife species. Specific impacts in the McMillan Delta area have occurred including development of roads, wells and pipelines. Isolated impacts may have occurred due to spills of oil waste or other accidental discharges. These impacts should be discussed on page 2-18.

These areas were not discussed because they are, for the most part, under private and state ownership. Since the BLM does not have control over these areas, impacts in these areas were not assessed. Standard operating procedures mitigate any problems on federal land by prohibiting activity within one quarter mile of rivers, marshes, reservoirs, or riparian habitats.

Response 2-9

Page 2-20, B.a. Terrestrial Plants: Mention is made that vegetation has been impacted due to oil and gas activities. Some quantification such as acres lost would be helpful to the reader in order to determine the overall significance of these activities.

Because there is no "typical" oil field, acreage estimates would be difficult and inaccurate. Depth of each well dictates the size of each pad. Varying spacing requirements, length of access roads and pipelines, and area required for different types of facilities all make areawide estimates impossible. As site specific assessments are made, acreage figures are determined and relative severity of impacts are noted based upon these figures and other pertinent site-specific data.

Response 2-10

Pages 2-20, 2-27 and 2-28, 3-34, 3-35 and 3-40. Threatened and Endangered Species: The discussion does not clarify if a species list has been obtained from the Regional Director and if Section 7 consultation required by the Endangered Species Act has been accomplished on oil and gas leasing activities. Also clarification should be made as to the procedures necessary to insure that individual leases will comply with requirements of the Endangered Species Act and Inter-agency cooperation Regulations.

See Response 2-2.

Page 2-25, 9. Wildlife: Mention should also be made of the McMillan and Avalon Lake areas and the New Mexico Department of Game and Fish's Artesia Farm. These are important to waterfowl resources in the Lower Pecos Basin of New Mexico.

Response 2-11

An introduction to chapter 2 has been added to clarify its purpose. As stated, the chapter discusses only those components of the environment which would actually be affected by the proposed action or alternatives. Because the analysis process did not reveal significant impacts upon these areas, they were not mentioned.

2012

Page 2-27, 9. Wildlife: During winter periods trout stocking is conducted by the New Mexico Department of Game and Fish in the Pecos River below McMillan Dam, in the Carlsbad Municipal Lakes and in the Black River.

2013

Page 2-45, 14a. Economic Environment and Page 3-66, 1) Economic Impacts: No mention is made regarding the contribution of fishing and hunting weekdays to the area economy. This may be of importance in evaluation of impacts of oil and gas activities.

2014

Page 3-32, 8. 3, 4, and 5. Vegetation Impacts: It is mentioned that certain soils such as caliche and limestone do not easily revegetate and that long term losses are expected. One possible mitigative measure for these expected losses would be the development of best management practices, and research and technical emphasis to develop management options to accomplish revegetation on abandoned sites.

The opportunity to review the draft environmental assessment is appreciated.

Joel A. Medlin
Joel A. Medlin

Response 2-12

The text has been revised to include this information.

Response 2-13

A brief discussion of fishing and hunting days has been added to the text.

Response 2-14

See Response 2-11.

8-4
1

cc:

Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Regional Director, FWS, Ecological Services, Albuquerque, New Mexico
Area Manager, Phoenix, U. S. Fish and Wildlife Service, Phoenix, Arizona



United States Department of the Interior

NATIONAL PARK SERVICE

SOUTHWEST REGION

P.O. Box 728

Santa Fe, New Mexico 87501

IN REPLY REFER TO
L7619(SMR) PE

SEP 10 1980

Mr. James H. O'Connor
District Manager
Bureau of Land Management
Roswell District Office
Post Office Box 1397
Roswell, New Mexico 88201

Dear Mr. O'Connor:

We have reviewed the Draft Environmental Assessment for Oil and Gas Leasing, Roswell District, Southeastern New Mexico, and offer the following general comments. The draft assessment does not address lands adjoining BLM-administered areas, particularly those in Federal ownership. Since proposed BLM oil and gas leases nearby Carlsbad Caverns National Park have involved consultation between the two agencies in the past, it is important that the ownership status of adjoining lands be included in the "Description of the Affected Environment" and that potential impacts be discussed. Aesthetic degradation of park vistas and physical disturbance of natural and cultural resources are our major concerns. Physical disturbances have primarily been related to the use or improvement of primitive access roads passing through the park. However, increasing oil and gas activity in the area poses the threat of "spill-over" impacts from drilling operations located just outside the park boundary (a lease under consideration reportedly involves a tract located only 650 feet outside the park).

Since Carlsbad Caverns National Park is located on the Gadsuque escarpment and adjoining BLM lands are generally at lower elevations, potential lease sites constitute the foreground and middleground of scenic vistas enjoyed by park visitors. The significance of these vistas to the visitor experience is emphasized by the fact that the majority of the park is designated wilderness (Public Law 95-625).

The local BLM staff has been keeping us informed of oil and gas activities proposed or approved near the park; it is our hope that this rapport and consultation will continue in the future.

Sincerely yours,

Associate Regional Director,
Planning and Cultural Resources,
Southwest Region

Response 3-1

The text has been revised to make it clear that the proposed action and affected environment sections pertain only to BLM's responsibility for development of mineral resources and the minimization of impacts. The BLM is required by policy to issue leases with the least stringent stipulations which will allow both mineral development and protection of other resource values. In special situations, some areas may be withheld from leasing if other resources cannot be adequately protected.

The BLM strives to minimize visual impacts which would "spill-over" on National Parks resulting from drilling operations on federal lands adjacent to the park. All lands, regardless of ownership, are evaluated under the BLM's visual resource management (VRM) system. However, BLM does not have any control over development of large areas of nonfederal lands or minerals adjacent to the park. The BLM will continue to seek park service involvement for all oil and gas activities near the park to minimize visual impacts.

Most of the area adjacent to the park is tentatively identified as VRM class II or III, which should adequately protect external vistas.



BRUCE KING
GOVERNOR

KATHLEEN R. HARR
SECRETARY

STATE OF NEW MEXICO
DEPARTMENT OF
FINANCE AND ADMINISTRATION
STATE PLANNING DIVISION

505 DON GASPAR AVENUE
SANTA FE, NEW MEXICO 87503
(505) 827-2079
(505) 827-5181
(505) 827-2138

ANITA HISENBERG
DIRECTOR

JOE GUILLEN
DEPUTY DIRECTOR

September 24, 1980

4 Phil Kirk
Bureau of Land Management
District Office
Post Office Box 1397
Roswell, New Mexico 88201

Dear Mr. Kirk:

Enclosed are comments on the Draft Programmatic Environmental Assessment Covering Continuation of Oil and Gas Leasing in Southeastern New Mexico. I received no comments from the Mining and Minerals Division; however, they informed me over the phone they found no problems with the Assessment. I also spoke with someone at the Southeastern New Mexico Economic Development District who said so far they have no problems with the Assessment. They will send comments directly to you if they find any problems. I have received no response from the Eastern Plains Council of Governments, but I will inform you of anything they come up with.

Thank you for your patience.

Sincerely,

Betsy Reed

Betsy Reed, Planner
Planning Bureau

BR:jeh

Enclosures

10-4



BRUCE KING
GOVERNOR
Kathleen R. Harr
SECRETARY

STATE OF NEW MEXICO
DEPARTMENT OF
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STATE PLANNING DIVISION

305 DON GASPAR AVENUE
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ANITA HISENBERG
DIRECTOR

JOE GUILLEN
DEPUTY DIRECTOR

September 23, 1980

4 (COND)

Comments on the Draft Environmental Assessment on the Continuation of
Oil & Gas Leasing in Southeastern New Mexico.

4-1

It appears that the problems concerning water resources are quite serious. Mitigating measures for these problems and all other resource conflicts should be stated as "will be carried out" rather than "could or should be carried out."

Response 4-1

The purpose for the mitigating measures has been further explained in the introduction to chapter 3. These measures are presented as options to the manager on a case by case basis, thus, the "could or should" terminology. In instances where the manager determines that the suggested measures are necessary. The measures will be stated as requirements in the special stipulations attached to authorizing documents.



STATE OF NEW MEXICO

STATE ENGINEER OFFICE
SANTA FE

S. E. REYNOLDS
STATE ENGINEER

September 22, 1980

BATAAN MEMORIAL BUILDING
STATE CAPITOL
SANTA FE, NEW MEXICO 87503

6

Mr. James H. O'Conner
District Manager
Bureau of Land Management
Roswell District Office
P. O. Box 1397
Roswell, New Mexico 88201

Dear Mr. O'Conner:

The opportunity to review your draft environmental statement covering continuation of oil and gas leasing and related activities on federal lands in Southeastern New Mexico is much appreciated. I offer no comments at this time.

Sincerely,


S. E. Reynolds
State Engineer

SER:pt

cc: Kate Wickes

4-12



STATE OF NEW MEXICO
DEPARTMENT OF
FINANCE AND ADMINISTRATION
STATE PLANNING DIVISION

BRUCE KING
GOVERNOR

DAVID W. KING
SECRETARY

505 DEN CASPAR AVENUE
SANTA FE, NEW MEXICO 87501
(505) 827-5075
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(505) 827-2108

July 15, 1980

ANITA HISENBERG
DIRECTOR

JOE GURLEN
DEPUTY DIRECTOR

Response 7- 1

The purpose of these letters is explained below:

In order to meet the requirements of section 105 of The National Historic Preservation Act of 1966 and sections 1(d) and 2(b) of Executive Order 11593, federal agencies must take the following steps:

1. Identification of resources

- Agencies must consult the Federal Register for a list of sites included on the National Register of Historic Places.
- To identify properties as eligible, the agency must, in consultation with the State Historic Preservation Officer (SHPO) apply The National Register criteria to each property. (Letters 8 and 9 are included to show that BLM has initiated this consultation).
- If the agency and the SHPO agree, the agency forwards a letter stating this agreement along with documentation on the sites to the keeper of the Register. The keeper responds regarding the eligibility of the property. (a letter dated September 11, 1980, was sent to the keeper of The National Register, Heritage Conservation and Recreation Service, Washington, D. C., to initiate this action. A copy of the letter is on file at the BLM'S Roswell District Office, file code 8110).

2. Determination of effect

The federal agency, in consultation with the SHPO, applies the criteria of effect to each property in the impact zone which is on or eligible for the National Register of Historic Places.

These determinations of effect are then sent to the advisory council for comment.

James H. O'Connor
District Manager
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88201

Attn: Ann Ramage

Dear Mr. O'Connor:

On July 10, 1980 Dan Reiley, Historic Preservation Bureau archeologist, and I met with Ms. Ann Ramage of your staff to determine the National Register eligibility or non-eligibility of certain archeological and historical sites in the Roswell District. This information is to be included in an Environmental Assessment Report or Environmental Analysis for oil and gas leasing in the District.

We reviewed the site information (36 CFR 63) necessary to make determinations, not only for our own purposes, but in order to assure ourselves that the Keeper of the National Register would find the site information adequate.

On the basis of this review, we found that the majority of the sites under discussion were not documented in enough detail to permit us to determine their eligibility or non-eligibility. The most common omissions on the site forms were site maps and summary statements of significance, although many forms were deficient in other ways. Sites falling into this category were:

44-062046, 2048, 143, 232, 228, 263, 243, 264, 778, 783, 1931, 1022, 10, 13, 1925, 1026, 1029, 2, 12, 1933, 1032, 3, 8, 5, 11, 1732, 1731, 1737, 1736, 1733, 212, 1628, 122, 1201, 124, 234, 55, 123, 127, 126, 167, 287, 126, 209, 1730, 1734, 1738, 1151, 1126, 1615, 1132, 1806, 1807, 1941, 1108, 975, 1921, 1610, 1636, 823, 1150, 1114, 1115, 1619, 1625, 1596, 1807, 1116, 729, 566, 686, 729, 566, 686, 729, 709, 725, 759, 655, 1660, 1862, 1865, 1889, 1858, 1824, 314, 679, 726, 310, 311, 312, 322, 320, 1329, 1328, 2098, 405, 404, 411, 412, 410, 435, 436, 437, 416, 417, 415, 414, 425, 446, 418, 420, 419, 424, 423, 648, 1608, 1635, 1627, 2105, 1601, 1742, 1582, 1595, 1634, 1592, 1591, 1504, 1623, 1624, 1612, 1611, 1859, 1153, 1614, 1814, 1149, 1943, 1817, 819, 618, 34, 1616, 692, 1618, 973, 1609, 1157, 1214, 1608, 2049, 303, 304, 300, 296, 297, 2054, 6, 268, 269, 293, 294, 270, 2058, 271, 273, 272, 292, 305, 61, 301, 2057, 295 and 306.

Sites NM-66-1021 and 1023 were of special interest to us. We agreed that they seemed unusual and perhaps highly significant, but we could not make a determination with the information we had. We found that a number of sites (which were adequately documented for the purpose of a determination) were ineligible; that is, not likely to yield significant information and not meeting any other criterion of eligibility.

4-7
3

Page 2.

These were:

7 (COND.)

IM-05-1602, 1625, 1599, 1100, 1956, 1605, 1112, 1152, 875, 990, 991, 2116, 958, 955, 3808, 1958, 1144, 1145, 1146, 1147, 1143, 1100, 1806, 1158, 1812, 362, 327, 1947, 971, 2119, 2114, 2110, 2111, 2123, 2112, 2120, 2104, 2105, 2106, 2107, 2108, 2115, 2109, 705, 392, 366, 706, 704, 382, 383 and 791.

We also found that a number of sites were likely to yield significant information about regional history or prehistory, and were therefore eligible to the National Register. These were:

AR-05-1630, 1632, 1629, 1631, 354, 939, 1855, 6815, 1939, 1813, 1951, 1852, 1842, 1856, 1853, 954, 952, 1131, 1089, 299, 6267, 290, 291, 2088, 307, 2117-2118, 993, 473, 950, 970, 946, 947, 1113, 1155, 1159, 974, 586, and 1956.

We can write a more detailed discussion of the nature of the eligibility of these sites if you will send us copies of the forms. Such a discussion may be required by the Keeper. We would prefer having your own analysis first, as a basis for any further remarks.

Obviously, this information, if used in an Environmental Assessment, will be very sketchy. There is no substitute for an archeological/historical reconnaissance or survey and assessment (Class I and II) designed with reference to the particular undertaking. The first group of sites listed above should also be re-recorded consistent with the standards and level of information of 35 CFR 63.

Please let me know how we can be of further assistance to you.

Sincerely,

Thomas W. Merlan
Thomas W. Merlan
State Historic Preservation Officer
Historic Preservation Bureau

TWM:jmg



BRUCE KING
GOVERNOR

DAVID W. KING
SECRETARY

7 (COND.)

STATE OF NEW MEXICO
DEPARTMENT OF
FINANCE AND ADMINISTRATION
STATE PLANNING DIVISION

505 DON GASPAR AVENUE
SANTA FE, NEW MEXICO 87503
DSM 827-2073
DSM 827-2455
DSM 827-2108

ANITA HERNANDEZ
DIRECTOR

JOE GULLEN
DEPUTY DIRECTOR

September 3, 1980

Mr. James O'Connor, District Manager
Bureau of Land Management
Roswell District
Post Office Box 1397
Roswell, New Mexico 88201

ATTN: Ann Ramage

Dear Mr. O'Connor:

Thank you for your letter of July 29, 1980 about a determination of eligibility to the National Register of Historic Places.

This is to confirm that we concluded that insufficient information existed to determine the eligibility or non-eligibility of NM-06-2046. We made the same finding regarding Sites 729, 366, 686, 791 (not 973) and 302.

I have noted for our records that the site I referred to as NM-06-1021 should have been NM-06-121, and that 2123 should have been 2113.

I have also noted that Site 6815 should have been referred to as 702, 1951 as 1851, 6267 as 267, 473 as 973 and 974 as 794.

In answer to your question about failure to comply with clearance procedures: such violations are grounds for revocation of federal leases, are grounds for suit by other parties such as public interest groups or private individuals, and may also, in the case of destruction of significant sites, result in criminal prosecution under the Archeological Resources Protection Act of 1979 (Public Law 96-95).

Thank you for your continuing cooperation.

Sincerely,

Thomas W. Merlan
Thomas W. Merlan
State Historic Preservation Officer
Historic Preservation Bureau

TWM:dg

NATIONAL WILDLIFE FEDERATION
NATURAL RESOURCE CLINIC
FLEMING LAKE, BOX 101
BOULDER, COLORADO 80309

September 25, 1980

9 District Manager
Bureau of Land Management
Department of the Interior
P.O. Box 1397
Roswell, NM 88201

Re: Draft Environmental Assessment NM 06080071

Dear Sir:

The National Wildlife Federation is America's largest private conservation organization, dedicated to the wise use and conservation of the nation's resources. We are pleased to comment as follows on the Draft Environmental Assessment related to oil and gas leasing in the Roswell District of New Mexico.

General Comments

9-1 We believe an Environmental Impact Statement should be prepared. We are particularly concerned with what we perceive as the deficiencies in BLM's assessment of the groundwater contamination problems present in the Roswell District. We believe that there may very well be a serious groundwater contamination problem in the Ogallala aquifer due to oil and gas mining operations. Your draft assessment recognizes such a problem, but we do not believe that the proposed action is adequate to meet the problem. We want a much more thorough investigation of the source and extent of the problem. Furthermore, it appears that enforcement of the BLM regulations is unsatisfactory. Enforcement arrangements must be improved.

Specific Comments

9-2 Page 324 of the Draft Environmental Assessment addresses the environmental impacts of your proposed action on the water resources of the area. It states:

"... sumps . . . may deteriorate and release pollutants into adjacent . . . groundwaters, if they are not properly disposed of according to regulations."

On page 25 of the Assessment it is stated that:

Response 9-1

See Response 2-1. In addition, the monitoring studies discussed in the draft E. A. were not done on the Ogallala formation. Rather, according to USGS, they were conducted on less important aquifers in Lea and Eddy counties. The suggested investigation on contamination of the Ogallala formation is beyond the scope of the BLM's authority. USGS is responsible for regulating "downhole" compliance and monitoring. A copy of Notice to Lessees (NXL) 2-8 concerning disposal of produced water, included as appendix B in the final document, spells out USGS's requirements for pollution prevention.

Response 9-2

See Responses 2-1 and 9-1. Coordination meetings are held on a continuing basis with USGS to help alleviate the problems discussed.

September 25, 1980

"An earlier review of the data regarding brine disposal in southern Lea County by Nicholson (Parker 1955, p. 626) lead to the conclusion that contamination of the groundwater must be taking place."

On page 326 you discuss mitigation of the environmental impacts of your proposed action. You state:

"Implementation of the standard operating procedures as expressed in the proposed action, would serve to minimize the effect of brine disposal on water quality."

The applicable proposed standard operating procedure can be found on page 131:

"Open sump pits containing liquid wastes would be fenced and covered to preclude access to these pits by wildlife. As an alternative, fiberglass tanks could be used instead of the open-earth pits which have been excavated but with the same access limitations required. Not only would these tanks be more efficient, but they could be moved to new locations as necessary."

Given the potential severity of the contamination problem, we believe that an EIS should be prepared. We feel certain that disposal of produced water should be in fiberglass tanks only.

In a July 15, 1980 letter from James H. O'Connor, BLM's Roswell District Manager, to the State Director, Mr. O'Connor wrote that the BLM favors the use of fiberglass tanks for disposal of produced water. We believe that BLM should require the use of fiberglass tanks for disposal of produced water. Not only would such a disposal method be safer in terms of groundwater contamination, in that BLM could require that the produced water be moved to an area where groundwater contamination could not occur, but the use of fiberglass tanks might well cost producers less than would the use of lined pits. The former have the advantage of being movable, so that they may be used for a longer period of time than can most lined pits.

The same letter complained of USGS's lack of diligence in enforcing BLM's recommended lease stipulations. Obviously, regulations and stipulations are meaningless if they are not enforced. An effective program of enforcement must be developed.

In your Draft Assessment you analyze the alternatives of the proposed action, no action, or historic management. We believe another alternative should be considered: temporary cessation of leasing pending a thorough investigation of the groundwater contamination problem and development of more effective regulation

Response 9-3

The alternative of temporary cessation of leasing, while perhaps desirable from an environmental standpoint, is not feasible under present policies established by the courts. Decisions have consistently held that refusal to lease "must be supported by facts of record that the lease would not be in the public interest because it is incompatible with uses of the land which are worthy of preservation or would otherwise be undesirable". (BLM 79-516, BLM 80-46, 80-92) Individual leases may be denied if they meet this criteria. However, denial on an areawide basis is not feasible under these policies.

4-17

9-3

District Manager, BLM

-3-

September 25, 1980

enforcement mechanisms. We believe that a cost-benefit analysis would indicate that the proposed action and the current enforcement problems would be more socially costly than ensuring that lessees contain their brine wastes more securely. While it is true that the Ogallala aquifer will eventually be depleted, the social dislocation of such a depletion can be minimized if the depletion occurs gradually. If, instead, the remaining water in the aquifer is contaminated to the point where it is no longer potable before the people relying on the aquifer have time to develop alternative sources of water, the social dislocation will surely be great.

9*4 We also request that oil and gas leases contain provisions requiring that lessees monitor groundwater supplies and report the acquired data to BLM so that adequate data on the extent of the problem can be developed. We believe such data is absolutely essential to proper management of this potentially critical environmental problem.

Sincerely,


Judy Howard
Legal Intern

dh

cc: Luke J. Danielson, Counsel, NWF

Response 9-4

While collection of this data is desirable, the BLM does not have the authority to require lessees to provide it. The USGS water resources Division does some monitoring in cooperation with the state engineer. In this document, BLM's concern for groundwater pollution is only addressed from the standpoint of surface spills which are under joint jurisdiction with USGS.

81-4
17

NEW MEXICO WILDLIFE FEDERATION

NEW MEXICO WILDLIFE FEDERATION
ALBUQUERQUE, NEW MEXICO 87101
TEL: (505) 261-1111
9-2-80

THE HAWKTON
PRESIDENT

10 James R. O'Connor, Manager
Newell District, ELA
Roswell, NM

Dear Snakey:

The New Mexico Wildlife Federation appreciate the opportunity to comment on your Draft Environmental Assessment, RE 060 80 071, Oil & Gas Leasing, Roswell District. It is a well done, easy to read and understand document.

We have two major general disagreements with the overall document:

1. You are very positive about what shall or will be done in most areas but when it comes to environmental impact, particularly under "Mitigation," in almost every case you revert to a passive use of "could" or "should" or "may". This use of passive wording when it comes to enforcement is very disturbing to the Federation and in our opinion makes for a very weak overall document when it comes to protecting public lands.

2. You seem to avoid using the term "sludge or sludge pits" almost entirely in the document. It is well known to all wildlife biologists in the area that hundreds of open and uncovered sludge pits cause thousands of wildlife deaths, particularly birds, annually. This seems to be a direct violation of Title 16, United States Code, Section 703, Killing of Migratory Birds.

There seems to be only two viable solutions to the sludge pit problem:

1. Require that separator wastes be pumped directly into an enclosed tank where oil will rise to the surface and water can be drawn out and reused or if clean can be used for wildlife and livestock.

2. Reinject separator wastes back into the well.

Both proposals will eliminate sludge pits and the health and environmental hazards that go with them. Many operators are now using both methods.

Page 1-9, c. Leasing. It appears from this sludge pits are authorized over the entire district except in prairie chicken habitat.

Page 1-11, f. The use of "may" is very disturbing here when it gives the impression you may permit drilling activities near a river, floodplain or riparian habitat. We would rather see you list strict regulations for such drilling.

Page 1-23. We applaud the practices listed for control of water treatment

Response 10-1

See Response 4-1.

Response 10-2

Through agreement with USGS, the standard operating procedures have been revised to require covering of all permanent pits with a fine mesh to prevent the problems identified.

Response 10-3

The pits are permitted, but now require covering as stated in Response 10-2.

Response 10-4

See Response 4-1.

Response 10-5

Nominal penalties may be assessed by USGS for failure to file for permits under NTL-8 or failure to report spills under NTL-3a. Leases may be "shut-in" by USGS for flagrant violations in which corrective measures are repeatedly ignored.

The USGS does enforce the practices, particularly those covered under NTL-2B.

*Dedicated to the Wise Use and Management of the Wildlife Resources
and the Natural Environment Upon Which All Life Depends*

NEW MEXICO WILDLIFE FEDERATION

THE VAL VERDE SITE
ALBUQUERQUE, NEW MEXICO 87105
TELEPHONE 845-5512

TOM THORNTON
PRESIDENT

and disposal, however you do not list any penalties if the practices are not followed. Are these practices now being enforced?

Page 1-31. Again, we urge the use of enclosed tanks.

10-6 Page 2-22. Why not list here the problems that the oil and gas industry cause wildlife?

10-7 Page 2-29. We strongly question the veracity of the statement, "An inventory of this area showed the opportunities for winter sports, water sports, collecting and sightseeing varied from severely limited to nonexistent." In our opinion the last three are fairly popular in the area.

10-8 Page 2-35. It would be helpful here if you would list the LSAs and deferred WSAs along with their respective acreages.

10-9 Page 2-52. Who made the determination that "ranching brings poor financial returns"? We believe this is not a common occurrence, as your statement would lead us to believe.

4-20 10-10 Page 1-31. Your statement, "In many cases, the proper use of fertilizer would be more than adequate as a replacement for the topsoil which was removed," simply cannot be true except as a very temporary measure.

10-11 Page 3-35. This first sentence is misleading. All wildlife will be affected, not just those listed in Table 3, Chapter 2, Threatened and Endangered Species.

We realize that the oil and gas industry is a vital part of our area and of the country and we certainly do not want to throw roadblocks in their path toward energy self sufficiency. On the other hand we care not let this drive for energy bring damage to public lands that will take centuries to repair.

A compromise fair to all is the only answer.

Sincerely

Tom Thornton
Tom Thornton
President

cc: Arthur Zimmerman
Sen Rosencni
Sen Schmitt
Rep LeJan
Larry Rehoe

Response 10-6

These problems are discussed in Chapter 3, "Environmental Consequences"

Response 10-7

The text has been revised to qualify the statement. Considering the planning criteria listed in BLM manual 6111, Opportunities on the public lands in the area are limited to nonexistent. The activities are limited either by climate or lack of necessary resources on the public lands.

Response 10-8

The text has been revised to present the latest data available, giving the acreages involved.

Response 10-9

The determination was based on a June, 1979, socioeconomic study of the East Roswell EIS area, conducted by Harbridge House. The study indicated that the returns were small in proportion to the capital outlay required to stay in business.

Response 10-10

The text has been changed to state that "The proper use of fertilizer as the topsoils are being replaced, would accelerate reestablishment of vegetative cover."

Response 10-11

The text has been modified.



Submitted to the New Mexico and Management of the Wildlife Resources
and the National Endowment for the Arts, New Mexico

CHAPTER 5

LIST OF PREPARERS

Chapter 5

PREPARERS

<u>NAME</u>	<u>EA ASSIGNMENT</u>	<u>POSITION</u>	<u>EDUCATION</u>	<u>EXPERIENCE</u>
David A. Atkins	Proposed Action and Alternatives and Carlsbad Resource Area Coordination	Supervisory Surface Reclamation Specialist	B.S. Biology, Kearney State College	BLM: 3.5 years. Army Corps of Engineers: 1 year.
Michael C. Bunker	Recreation, Visual Resources, and Wilderness Studies	Outdoor Recreation Planner	B.S., Forest Management, Utah State U., Logan	BLM: 7.5 years.
Lorraine G. Cobos	Drafting, Printing of Draft	Drafting Assistant	1 year Eastern New Mexico University, Roswell	BLM: 7 months
Levi D. Deike	Overall Review	Natural Resource Specialist and Surface Protection Coordinator	B.S., Agriculture, Southwest Texas State University	BLM: 16.5 years.
Howard S. Gebel Jr.	Air Quality, Water Resources, *T&E Plants, and Vegetation	Range and Watershed Specialist	B.S., Range Management, Texas A&M	BLM: 22 years.
Karen Goesch	Compositor	Clerk-Typist		
Thomas H. Hewitt	Coordination for Roswell Resource Area, Preparation of Proposed Action and Alternatives	Supervisory Natural Resource Specialist	B.S., Environmental Biology and Organic Chemistry, U. Texas, Austin. Graduate Study; LSU	BLM: 4.5 years.

*T&E = Threatened or Endangered

Chapter 5

PREPARERS (Cont.)

<u>NAME</u>	<u>EA ASSIGNMENT</u>	<u>POSITION</u>	<u>EDUCATION</u>	<u>EXPERIENCE</u>
L. Mark Hollis	Team Leader and Technical Coordinator	Environmental Coordinator	A.A., Otero Jr. College, LaJunta, Colorado, B.S., Biological Science, Colorado State U., Ft. Collins	BLM: 14.5 years.
Larry A. LaPlant	Wildlife and T&E Animals	Wildlife Biologist	B.S., Wildlife Management, U. Montana, Missoula	BLM: 2.5 years. Department of the Army: 12 years
Angie Medina	Compositor	Clerk-Typist		
Hubert Phillips	Writer-Editor, Socioeconomics	Writer- Editor	B.A., History and Sociology, M.A.T., History and Government, Angelo State University, Texas	BLM: 3 years. Department of the Air Force 24.5 years
E. Ann Ramage	Cultural Resources	Archeologist	B.A., Anthropology, U. of NM, Albuquerque	BLM: 4.5 years.
Allan T. Schmidt	Topography, Geology, Minerals and Land Use, Paleontology	Geologist	B.S., Geology, U. Illinois, Champaign. M.S., Geology, U. Florida, Gainesville	BLM: 3.5 years. Bureau of Mines: 2 years
Clarence R. Seagraves	Soils	Soils and Watershed Specialist	B.S., Agronomy, NM State U., Las Cruces	BLM: 4 years. SCS: 5.5 years.
Sherry Spurrier	Compositor	Clerk-Typist		BLM: 2.5 years

APPENDICES



Appendix A

CURRENT AND PROPOSED STANDARD OPERATING PROCEDURES

Standard operating procedures now being used by the Bureau of Land Management (BLM) have been developed through consultation, cooperation, and coordination with many federal, state, and private agencies and groups. These include: the U. S. Geological Survey (USGS) and other federal agencies, state agencies such as the New Mexico Department of Game and Fish and the State Historical Preservation Officer, Representatives of the petroleum industry, and the general public such as ranchers and farmers.

Information gained through these cooperative and consultative processes has contributed to the development of the BLM's planning system and the original Oil and Gas Environmental Assessment, prepared in 1974. These standard operating procedures were developed to mitigate known and/or expected impacts to the environment and to other ongoing and/or other potential uses of the public lands.

These procedures are divided into two categories: (1) Current standard operating procedures, and (2) Proposed standard operating procedures. Because the USGS is responsible for compliance and enforcement all operating procedures (issued as schedules or stipulations) must have USGS concurrence. The current operating procedures are those which now have their concurrence. Proposed procedures are the result of the Bureau planning system's management framework plan (MFP) decisions, but have not yet received USGS concurrence.

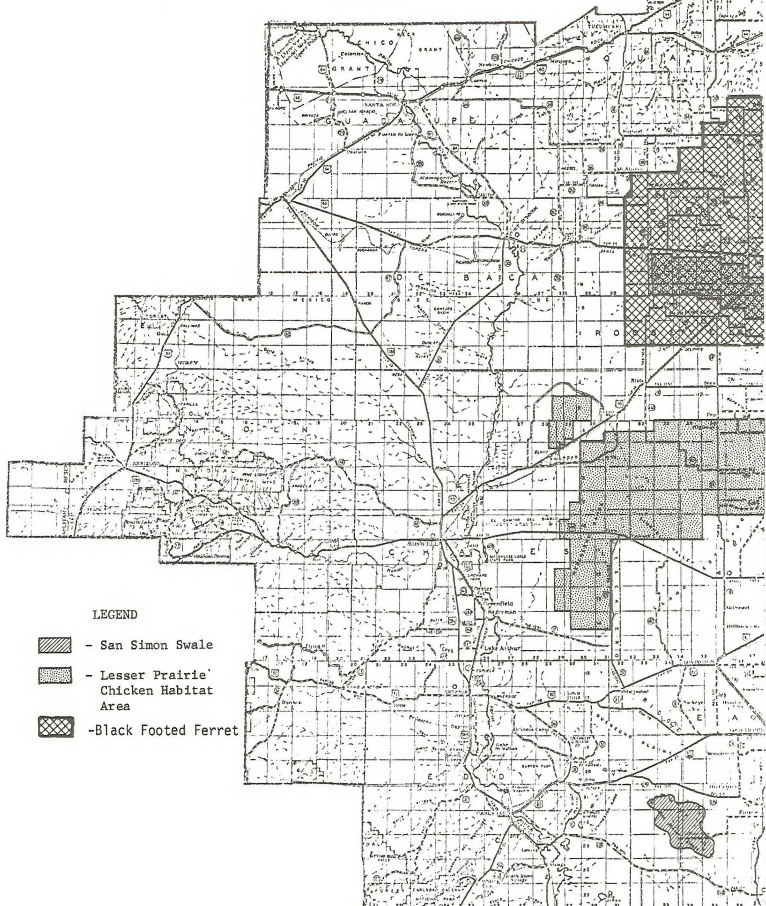
A. Current Standard Operating Procedures

1. Leasing

a. In cave areas, drilling operations would not be conducted within 100 yards of any cave entrance, known passageway, or other subterranean aspect. Sludge oil disposal pits would not be located within 200 yards of known and surveyed cave entrances, underground passageways, or in other locations where the cave resources would be endangered by seeping oil or waste products. Such pits would not be located in sink holes, near fractures, or near cave entrances. All pits would be lined with an impervious material. Drilling sites would be cleared in a manner which would prevent an increase of natural water flow into cave entrances or aspects.

b. In the San Simon Swale (Map 2), exploration, abandonment, and/or drilling activities would not be allowed between April 15 and June 15 without specific BLM authorization. Drilling sites would not be located in forb-producing depressions on the swale bottom.

Map No. 2
Sensitive Areas For Oil
And Gas Leasing
Wildlife



c. In the lesser prairie chicken habitat area (Map 2) all site selections for roads and pads must be coordinated with BLM's Roswell District Manager to protect booming grounds and nesting sites. To avoid disturbance during the breeding season, exploration, abandonment, and drilling activities would be prohibited between April 1 and May 31. Structures would not be permitted on the cleared area, except as defined by stipulations. All pits for collecting waste crude oil or caustic fluids or water must be covered with a fine mesh netting.

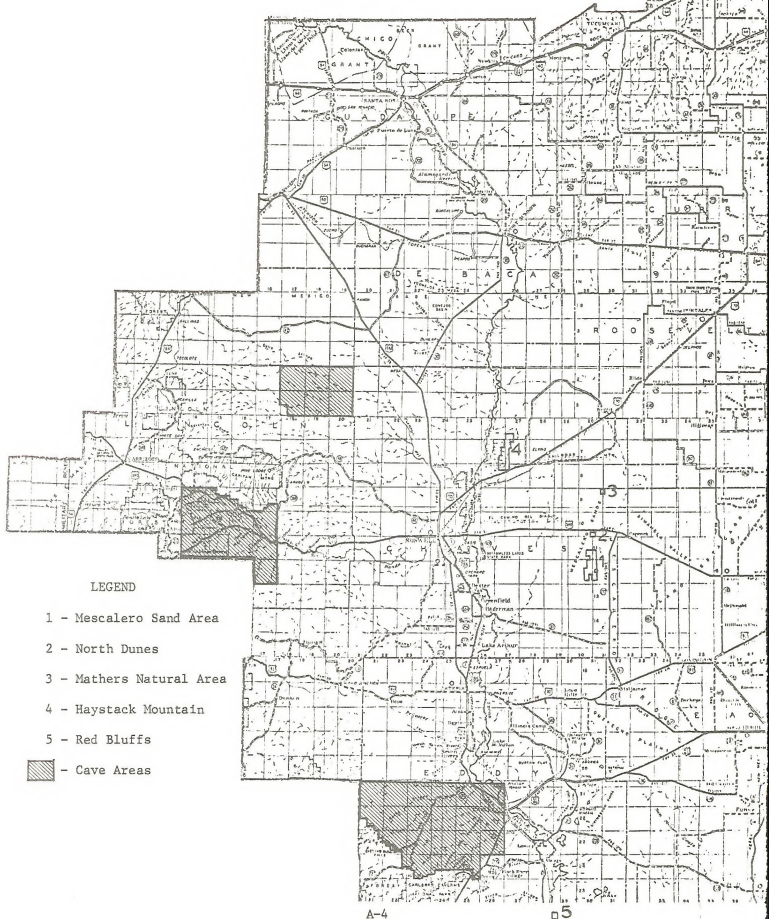
d. Portions of the Mescalero Sands Outstanding Natural Area (Map 3) and the Mathers Natural Area (Map 3) are included in the lesser prairie chicken habitat area. Therefore, all protective measures apply for that area. In addition, off-road vehicular travel is not authorized in these areas. Surface facilities must be located outside these areas to protect cultural resources, sensitive wildlife species, and an undisturbed shinnery oak/tall grass prairie vegetative type. To assure this protection, only off-site slant drilling would be authorized.

e. Off-road vehicular travel would not be permitted within the proposed Guadalupe Wilderness Area and only off-site drilling would be allowed. All surface facilities would be located outside the area. All other lands under consideration for their wilderness potential would be leased only if the Wilderness Protection Stipulation is attached. (Map 5). This stipulation, which is contained in Appendix A of the Interim Management Policy of December 12, 1979, prohibits all lease activities which would impair the area's suitability for designation as a wilderness area. Temporary impacts which are reclaimable by the time that the Secretary of the Interior makes his recommendations as to the suitability or unsuitability of an area for designation as a wilderness area, would be allowed. Lease exploration or development activities would be regulated to prevent impairment of wilderness values, except for a continuation in manner and degree of physical impacts which had started prior to October 21, 1976.

f. Major rivers and drainages. Exploration and/or drilling activities would be prohibited within one quarter mile of river channels, marshes, reservoirs, or riparian habitats (Map 5). Permanent improvements and/or operations would not be permitted in floodplains without approval of BLM's Roswell District Manager. Powerline crossings would be buried, if they must be routed within one quarter mile of reservoir perimeters.

g. To protect antiquities and objects of historical value, the lessee must bring any such items to the attention of the authorized officer immediately. Included, but not limited to, prehistoric or historical ruins, fossils, or artifacts which are discovered as a

Map No. 3
Sensitive Areas For Oil
And Gas Leasing
Recreation




LEGEND

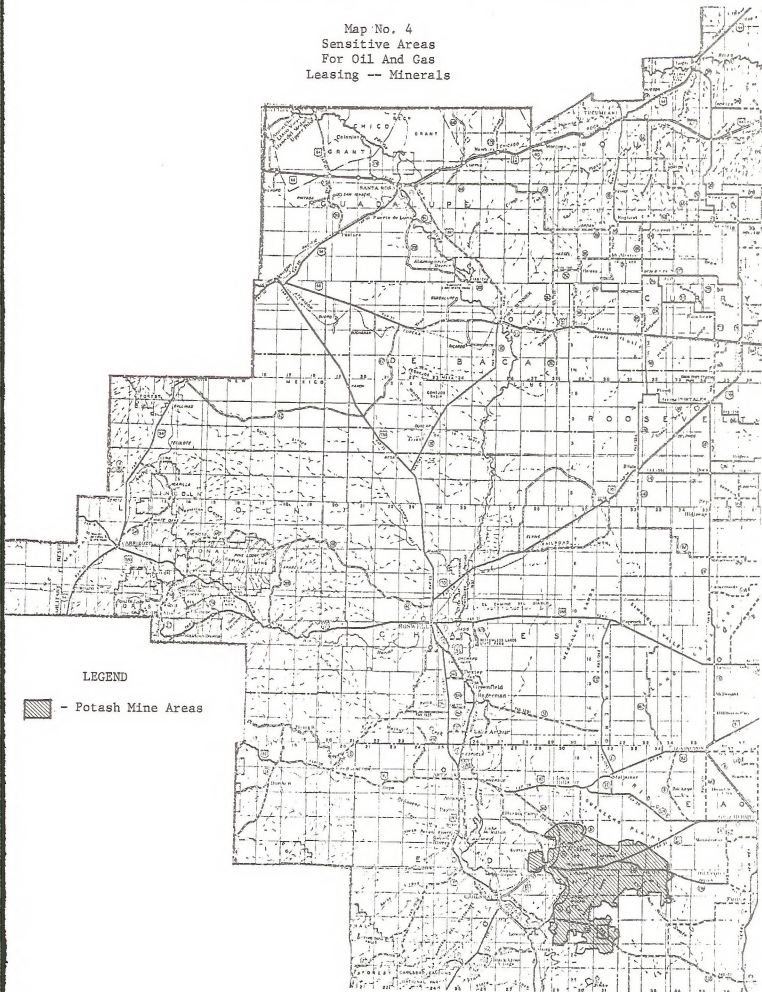
- 1 - Mescalero Sand Area
- 2 - North Dunes
- 3 - Mathers Natural Area
- 4 - Haystack Mountain
- 5 - Red Bluffs

 - Cave Areas

Map No. 4
Sensitive Areas
For Oil And Gas
Leasing -- Minerals

LEGEND

 - Potash Mine Areas



result of operations authorized under the lease. Such discoveries should be left intact and undisturbed by the lessee.

h. To protect watersheds, surface occupancy would not be allowed on slopes in excess of 40 percent without special approval of the USGS, with BLM concurrence. During muddy and/or wet periods, exploration, drilling, or other development activities would normally be prohibited. However, activities would be permitted during inclement weather conditions if significant emergencies, such as blowouts, fires, or other life-threatening events develop.

i. To maintain esthetic values, all high visibility semipermanent and permanent facilities would require painting or camouflage to minimize visual impacts. (See Appendix A-1)

j. To control pollution, leases would be subject to all relevant federal, state, or local legislation concerning pollution control. Such pollution controls must be agreed to by the lessee. This legislation includes, but is not limited to, the Clear Air Act as amended (77 Stat. 392, 42 USC 1857-18571), The Refuse Act of 1899 (30 Stat. 392, 33 USC 407-409), The Federal Water Pollution Control Act (63 Stat. 1155, 33 USC 1151-1161).

k. Maroon Cliffs Archeological District in the following sections (Section 8: S₂NE₄, S₂NW₄, NE₄NW₄; Section 9: W₂, NE₂NE₄, W₂NE₄, N₂SE₄, NE₄, NW₄SE₄, W₂SW₄SE₄; and Section 17: T. 21 S., R. 30 E.) all of the following restrictions must be strictly adhered to:

1. Off-road vehicular traffic would not be authorized.
2. Surface facilities (tank batteries, separators, dehydrators, etc.) would be located outside the area.
3. Only off-site drilling is authorized.

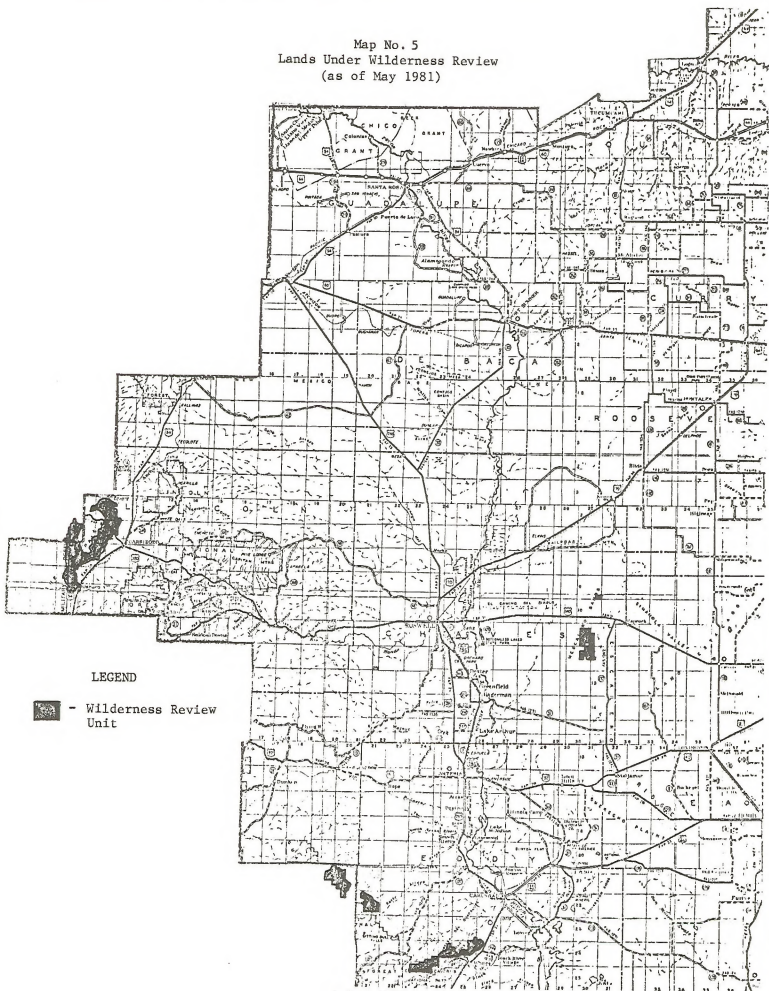
The rest of the designated archeological district will be leased without the above no-surface stipulations. This would be done with the understanding that this area contains a high density of archeological sites and that each request for drilling will be thoroughly checked for archeological values prior to its authorization.

1. Geophysical and/or Geochemical Exploration: Any person or company desiring to conduct oil and gas exploration on BLM managed lands must file a "Notice of Intent" with the District Manager on a signed 3040-1 form available from BLM. In addition, a map indicating the complete exploration route must be submitted. Standard operating procedures agreed on form 3040-1 are:

1. Exploration operations shall be conducted in compliance with all Federal, State and County laws and regulations applicable to the area of operations including, but not limited to fire, sanitation, conservation, water pollution, fish, and game. All operations shall be conducted in a prudent manner.
2. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to gates, bridges, roads, culverts, cattle-guards, fences, dikes, dams, vegetative cover, and improvements (no blading without permission) and to stock watering or other facilities.
3. When not in use, all shafts, pits, and shot holes shall be capped for the safety of other persons, wildlife, and livestock.
4. All vehicles shall be operated in a prudent manner on existing roads and trails. If new roads or trails are necessary, care should be taken to follow existing contours where this is feasible, and disturbed surfaces must be restored as required by the BLM. Bulldozers shall not be used without the District Manager being notified in advance.
5. All equipment shall be removed and the land restored to its original condition to the satisfaction of the District Manager upon abandonment of operations.
6. The location and depth of any water sands encountered shall be made known to the District Manager upon request.
7. A "Notice of Completion", Form 3045-2, shall be submitted by the operator upon the completion of operations.

M. All permanent sump pits will be fenced to exclude livestock. Where wildlife mortalities are likely, pits will be covered with a fine mesh netting. As an alternative, fiberglass tanks may be used as long access is restricted in the same manner as for pits. All pits will be constructed and maintained according to the U. S. Geological Survey's notice to Lessees (NTL) 2-B. (Appendix B).

Map No. 5
Lands Under Wilderness Review
(as of May 1981)



LEGEND



- Wilderness Review
Unit

N. Protection of Endangered or Threatened Species

The Federal Surface Management Agency is responsible for assuring that the area to be disturbed is examined prior to undertaking any surface-disturbing activities on lands covered by the lease, to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened or their habitats. If the findings of this examination determines that the operation may detrimentally affect an endangered or threatened species, some restrictions to the operator's plans or even disallowances of use may result.

The lessee/operator may, at his discretion and cost, conduct the examination on the lands to be disturbed. This examination must be done by or under the supervision of a qualified resource specialist approved by the Surface Management Agency. An acceptable report must be provided to the surface management agency identifying the anticipated effects of the proposed action on endangered or threatened species or their habitat.

O. Protection of Cultural and Paleontological Resources

1. The Federal Surface Management Agency is responsible for determining the presence of cultural resources and specifying mitigation measures required to protect them. Prior to undertaking any surface-disturbing activity on the lands covered by this lease, the lessee/operator unless notified to the contrary by the authorized officer of the surface management agency, shall:

- a. Engage the services of a qualified cultural resource specialist acceptable to the Surface Management Agency to conduct an intensive inventory for evidence of cultural resource values;
- b. submit a report acceptable to the authorized officer of the Surface Management Agency and the District Engineer of the Geological Survey; and
- c. implement such mitigation measures as required by the authorized officer of the Surface Management Agency to preserve or avoid destruction of inventoried cultural resource values. Mitigation may include relocation of proposed facilities, testing and salvage or other protective measures deemed necessary. All costs of the inventory and mitigation shall be borne by the lessee/operator and all data and materials salvaged shall remain under the jurisdiction of the U.S. Government.

2. The lessee/operator shall immediately bring to the attention of the District Engineer of the Geological Survey and the authorized officer of the Surface Management Agency any cultural resources, paleontological and other objects of scientific interest discovered as a result of surface operations under this lease and shall leave such discoveries intact until directed to proceed by the District Engineer.

P. Wilderness Protection

By accepting this lease, the lessee acknowledges that the lands contained in this lease are being inventoried or evaluated for their wilderness potential by the Bureau of Land Management under section 603 of the Federal Land Policy and Management Act of 1976, 90 Stat. 2743, 2785 (43 U.S.C. Sec. 1782).

Until the BLM determines that the lands covered by this lease do not meet the criteria for a wilderness study area as set forth in section 603, or until Congress decides against the designation of lands included within this lease as "wilderness," the following conditions apply to this lease, and override every other provision of this lease which could be considered as inconsistent with them and which deal with operations and rights of the lessee:

1. Any oil or gas activity conducted on the leasehold for which a surface use plan is not required under NTL-6 (for example; geophysical and seismic operations) may be conducted only after the lessee first secures the consent of the BLM. Such consent shall be given if BLM determines that the impact caused by the activity will not impair the area's wilderness characteristics.

2. Any oil or gas exploratory or development activity conducted on the leasehold which is included within a surface use plan under NTL-6 is subject to regulation (which may include no occupancy of the surface) or, if necessary, disapproval until the final determination is made by Congress to either designate the area as wilderness or remove the section 603 restrictions.

If all or any part of the area included within the leasehold estate is formally designated by Congress as wilderness, oil and gas exploration and development operations taking place or to take place on that part of the lease shall become subject to the provisions of the Wilderness Act of 1964 which apply to national forest wilderness areas, 16 U.S.C. Sec. 1131 et seq., as amended, the Act of Congress designating the land as wilderness, and Interior Department regulations and policies pertaining thereto.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Area Oil and Gas Supervisor or
District Engineer (Address, include zip code)

SURFACE DISTURBANCE STIPULATIONS

Management Agency (name)

Address (include zip code)

1. Notwithstanding any provision of this lease to the contrary, any drilling, construction, or other operation on the leased lands that will disturb the surface thereof or otherwise affect the environment, hereinafter called "surface disturbing operation," conducted by lessee shall be subject, as set forth in this stipulation, to prior approval of such operation by the Area Oil and Gas Supervisor in consultation with appropriate surface management agency and to such reasonable conditions, not inconsistent with the purposes for which this lease is issued, as the Supervisor may require to protect the surface of the leased lands and the environment.

2. Prior to entry upon the land or the disturbance of the surface thereof for drilling or other purposes, lessee shall submit for approval two (2) copies of a map and explanation of the nature of the anticipated activity and surface disturbance to the District Engineer or Area Oil and Gas Supervisor, as appropriate, and will also furnish the appropriate surface management agency named above, with a copy of such map and explanation.

An environmental analysis will be made by the Geological Survey in consultation with the appropriate surface management agency for the purpose of assuring proper protection of the surface, the natural resources, the environment, existing improvements, and for assuring timely reclamation of disturbed lands.

3. Upon completion of said environmental analysis, the District Engineer or Area Oil and Gas Supervisor, as appropriate, shall notify lessee of the conditions, if any, to which the proposed surface disturbing operations will be subject.

Said conditions may relate to any of the following:

- (a) Location of drilling or other exploratory or developmental operations or the manner in which they are to be conducted;
- (b) Types of vehicles that may be used and areas in which they may be used; and
- (c) Manner or location in which improvements such as roads, buildings, pipelines, or other improvements are to be constructed.

2. Rights-of-Way

The following procedures apply to most oil and gas associated rights-of-way in the Roswell District, unless otherwise specified. These measures are coded by the following designations: pipelines, PL; underground cables, UC; storage facilities, SF; water treatment and injection, WT; cathodic protection systems, CP; electric distribution lines, EL; compressor stations, CS; communication sites, CM; and roads, R.

a. The right-of-way grantee must notify the District Manager prior to the date that construction is to begin and the date that construction has been completed. Proof of construction must be submitted to the authorized officer within 90 days after completion of construction or after all restoration stipulations have been complied with, whichever is later. A period of five years is allowed for completion of construction from the date a right-of-way is granted. (PL, UC, SF, WT, CP, EL, CS, CM)

b. During operations, if the right-of-way grantee discovers any historic or prehistoric ruin, monument, or site,; or any object of antiquity subject to the Antiquities Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. Secs. 431-433), and 43 CFR Part 3, work would be suspended and the discovery promptly reported to the District Manager. The Bureau would then take such actions as required under the Act and regulations thereunder. When directed by the District Manager, the right-of-way grantee will obtain a qualified archeologist to examine and either excavate or gather such ruins or object as necessary to preserve such artifacts. (PL, UC, SF, WT, CP, EL, CS, CM)

c. Clearing and blading necessary for construction must be held to the absolute minimum. Without prior agreement, these actions would not exceed those limits agreed upon at the preconstruction inspection. Vegetation removed must be "walked-down" in place during cleanup operations after construction is completed. (PL, UC, CP, R, CS)

d. The grantee must post the BLM serial number assigned to the right-of-way in a conspicuous place where the right-of-way intersects existing roads or highways. Along rights-of-way paralleling roads or highways, BLM serial numbers should be posted where the right-of-way first crosses the public lands and where it finally leaves the public lands. (PL, UC, CP, CS, EL, WT)

e. Roads would not be constructed where terrain features permit vehicles to maneuver without the aid of such construction. All vehicular traffic and construction activity would be confined to the authorized right-of-way. (PL, UC, CP, WT, EL, CS)

f. Certain aboveground structures which are not subject to safety requirements, would be painted by the grantee to blend with the natural landscape. The paint used would be a color which simulates Federal Standard No. 595A: color 20318 (Sandstone brown, semi-gloss), color 30318 (Sandstone brown, flat), color 26357 (Sagebrush gray, semi-gloss), color 36357 (Sagebrush gray, flat), or other, depending upon the surroundings. (PL, CP, CS, WT)

g. Care must be taken by the grantee to assure that scenic values are not damaged in the disposal of waste materials. Any large rocks which are left in the area as a result of construction activities would be placed so that they do not detract from the scenic view and do not hinder the movement of livestock or big game animals. These residual rocks would not be piled or left in rows. (CP, EL, R, PL, UC)

h. In those areas where erosion control structures are required to stabilize soil conditions, the grantee must install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices. (PL, UC, CP, CS, EL, CM, R, WT)

i. To prevent slacking of fence wire, the grantee must brace and tie-off each existing fence to be crossed before cutting. During construction, the opening must be protected to prevent the escape of livestock. Fences which have been cut during construction must be restored to their original condition, or better, by the grantee. Cattle-guards and adjacent gates which are of suitable width would also be installed in any fence where the right-of-way is to be regularly traveled. (PL, UC, EL, R)

j. If a natural barrier which is being used for livestock control, is broken during construction, the grantee must adequately fence the area to prevent drift of livestock. (PL, UC, EL, R, SF, WT)

k. Compatible with construction requirements, the period of time that trenches and other excavations would be kept open by the grantee must be held to a minimum. (PL, UC, CP, WT)

l. Rights-of-way would not be fenced, nor would public access to a right-of-way constructed on public land be restricted by the grantee, without specific written approval being granted by BLM's Roswell District Manager. Gates or cattleguards located on public lands would not be locked or closed to public use. (PL, UC)

m. Prior to using any mineral materials, such as caliche or sand and gravel which would be removed from any existing or proposed

federal source, authorization must be obtained from the BLM Roswell District Manager or his designated representative. (R)

n. Upon cancellation, relinquishment, or expiration of a right-of-way grant, the grantee must comply with those abandonment procedures as prescribed by BLM's Roswell District Manager. (PL, UC, SF, WT, CP, EL, CS, CM, R)

B. Additional Procedures Required

In addition to these standard procedures for rights-of-way, measures which are specific to the facility would also be required. These include:

1. Water Treatment and Disposal

a. Grantee must not permit any of his actions involved with a grant to pollute land resources or surface waters and must not allow salt water to enter any formation which contains potable water. The operator must dispose of all liquid and nonliquid waste materials as prescribed by applicable federal and state regulations.

b. Storage tanks, pipes, and other improvements must be kept in good condition with leaks being repaired immediately to prevent environmental damage to either land or water resources. Care must be taken by the grantee to assure that scenic values are not damaged in the disposal of waste materials.

c. For disposal wells, the grantee must have advance approval from the Oil Conservation Commission (OCC) must comply with their order stipulations as well as the following USGS stipulations:

- 1) To use the well solely for salt water disposal.
- 2) To assume all responsibility for the well under the right-of-way, including the proper operation of the well for disposal purposes, plugging of the well and complying with other abandonment procedures when the well is no longer used for the disposal of salt water, and restoration of the land surface to near it's original condition, or as specified by BLM's Roswell District Manager.

- 3) Prior to commencing salt water disposal actions, grantee must condition the well in a manner which is satisfactory to the appropriate District Engineer, U. S. Geological Survey.
- 4) Prior approval of the District Engineer, U. S. Geological Survey, must be secured before commencing any operations such as: drilling out cement plugs, cementing operations, perforating, using explosives or hydraulic fracturing, deepening, altering, or pulling a portion of the well's casing, plugging operations, or any other operation affecting the well.

2. Electric Distribution Lines

a. Powerlines must be constructed according to standards as outlined in Suggested Practices for Raptor Protection on Powerlines, Raptor Research Foundation, Inc., Department of Zoology - 167 WIBD, Brigham Young University, or Rural Electrification Bulletin 61-10, dated September 14, 1973, entitled "Protection of Bald and Golden Eagles from Powerlines." These publications provide sufficient information on phase spacing, configuration, and grounding to preclude the existence of significant hazards to large perching birds. The BLM reserves the right to require modifications on all additions to powerline structures placed on the right-of-way, should they be determined necessary to ensure the safety of large perching birds. Such modifications and/or additions must be made by the grantee, without liability or expense to the United States.

b. Industry officials must assume the burden and expense of proving that pole designs not shown in Suggested Practices for Raptor Protection on Powerlines or in Rural Electrification Bulletin 61-10, are "raptor safe." Such proof must be provided by a raptor expert approved by the BLM District Manager.

3. Compressor and Plant Sites

The grantee must take those actions necessary which will assure that land or water resources do not become polluted because of the actions authorized by the grant, that any existing aquatic life is not damaged, and that extraneous matter does not enter and damage any mineral or water-bearing formation. All liquid and nonliquid waste materials must be disposed of by the operator as prescribed by applicable federal and state regulations.

4. Communication Sites

a. The grantee must notify the Roswell District Manager or his representative within 10-20 days prior to the start of construction.

b. The grantee shall furnish the authorized BLM officer a copy of the Federal Communications Commission (FCC) license or Inter-departmental Radio Advisory Committee (IRAC) radio frequency assignment which is currently valid, within 10 days after issuance of the license or assignment of the frequency. Any interference with existing electronic users which is caused by the facilities authorized under the grant must be remedied by the grantee, at his own expense. The responsibility of preventing interference with the facilities authorized by other electronic users in the vicinity, shall be limited to compliance with the appropriate FCC or IRAC operating standards.

c. The grant of right-of-way shall terminate 60 days after expiration or cancellation of the FCC license or IRAC radio frequency assignment, unless renewal is obtained within this period and a copy of such renewal is furnished to the Bureau of Land Management. Grantee must comply with those abandonment procedures as prescribed by BLM's Roswell District Manager and must return the site to a condition which is acceptable to him.

d. The right-of-way grant is not assignable without the written permission of the BLM's Roswell District Manager. Electronic facilities installed on a site shall not be operated by any person or organization other than the grantee, its agents, and/or employees.

e. The grantee must not install or permit the installation of electronic equipment belonging to another organization or person in the grantee's buildings, nor shall any other organization or person attach such equipment to the grantee's antenna or supporting structures without obtaining a separate right-of-way from the BLM District Manager or his representative, authorizing joint-occupancy of the facilities authorized by a grant. In the event that joint-occupancy is permitted, the new grantee must also comply with all BLM stipulations.

f. Minimum construction and maintenance standards which must be maintained by the grantee include:

- 1) Antenna supports must conform to the installation specifications of the tower manufacturer. Any variance shall only be that minimum required because of local terrain or obstructions at the specific site. Variances must conform to good engineering practices as defined by BLM's Roswell District Manager.

- 2) All electronic installations and facilities must conform to the current national electronic safety code, local laws, and/or regulations.
- 3) Installations must include an effective lightning ground in accordance with the "cone of protection" theory. All electrical outlets shall be of the "three conductor" grounding receptacle-type. All electrical or electronic equipment cabinets must be properly connected to the system ground and all grounding must be interconnected.
- 4) Copies of the amended FCC construction permit or license, or IRAC frequency assignments, together with corrected block diagrams, must be filed with the Bureau of Land Management, before modification of previously authorized facilities are approved.
- 5) All installations, buildings, antenna supports, etc., must be maintained in a safe condition in accordance with good engineering practices and the site, together with its facilities, must be kept in a condition which is not unsightly. These standards will be defined by the Roswell District Manager, BLM.

g. The Bureau of Land Management retains the right to inspect the site at any time to insure compliance with the terms, conditions, and stipulations of the right-of-way grant.

h. All construction and vehicular traffic must be confined to the authorized right-of-way. The federal government reserves the right of access to any road created as a result of the grant of right-of-way and the right to extend such rights to others, provided such use would not unduly interfere with the use of the road by the grantee in the opinion of the Roswell District Manager, BLM.

B. Proposed Standard Operating Procedures

1. Exploration, abandonment, or drilling activities would be avoided within 300 yards of active raptor nests during the nesting period from April to August to prevent disturbances by oil and gas activities.

2. Lands within the Haystack Mountain, North Dunes, and Red Bluffs Recreation sites would be leased, subject to the condition that

surface disturbances would be prohibited within 1,000 feet of potential development areas, unless a specific exception is granted by the BLM's Roswell District Manager.

3. All vehicle use which occurs as a result of the proposed action will be conducted in accordance with off-road vehicle designations and management regulations (43 CFR 8340). Exceptions to this limitation may be specifically authorized in writing by BLM's Roswell District Manager.



United States Department of the Interior

6300 (932)

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BUREAU OF LAND MANAGEMENT

NEW MEXICO STATE OFFICE

P.O. BOX 1449

SANTA FE, NEW MEXICO 87501

JUN 21 1976

Instruction Memorandum No. NMSO 78-131

Expires: 9/30/79

To: District Managers, State Office Division & Staff Chiefs

From: State Director

Subject: Method for Determining Painting Stipulations on Oil & Gas Applications for Permit to Drill

As a result of the painting committee effort between USGS, Forest Service, private industry, and BLM, the following method will be used in implementing Standard Stipulation No. 10 for painting oil and gas production structures.

1. Standard Stipulation No. 10 will be attached to all new leases where facilities will require painting to reduce the visual impact of color. This pertains to all new leasing actions on federally administered public lands to include mineral management responsibility on the federal subsurface estate. It also applies to new actions on old existing leases.
2. The visual impact will be determined through the Bureau's Visual Resource Management contrast rating system. The critical viewpoint in seldom seen areas will be approximately $\frac{1}{4}$ mile from the proposed facility at a location which is most likely to be used by observers. The contrast rating should be conducted during the joint field inspection with the G. S. representative and field operator. At that time, in addition to any other surface protection measures required, the color and type of equipment to be painted will be specified.
3. The painting stipulations agreed upon will then be sent to USGS for inclusion in the Plan of Operation as a condition for approval of the Application for Permit to Drill. These stipulations should be as specific as possible. Wording should be similar to "...unless mutually agreed, as a minimum the following permanent facilities will be painted the specified color. . . ." Typical facilities that would require painting might include all high level equipment such as tanks, separators, heater treaters (except fire box and stack), large flow lines (above 4 inches) and equipment buildings. Small size flow line, low level equipment and small or galvanized wire or pipe not normally painted may not require painting. If this type of equipment is normally painted or painted from previous use, the contrast of color will be considered in the painting requirements. It is desirable that as much equipment as possible be painted a uniform non-contrasting color if it's going to be painted anyway.

4. Permanent structures are considered to be those facilities which are on-site more than 90 days after completion of the drilling and testing phase.

5. The following standard colors (or equivalent colors subject to approval by BLM) will be specified. The option of using flat or semi-gloss paint shall be given to the operator.

a. Northwest New Mexico

- (1) #595,30318 (sandstone brown-flat)
#595,20318 (sandstone brown-semi-gloss)
- (2) #595,36357 (sagebrush gray-flat)
#595,26357 (sagebrush gray-semi-gloss)
- (3) #595,34127 (pinon-juniper green-flat)
#595,24127 (pinon-juniper green-semi-gloss)

b. Southeast New Mexico

- (1) #595,30318 (sandstone brown-flat)
#595,20318 (sandstone brown-semi-gloss)
- (2) #595,36357 (sagebrush gray-flat)
#595,26357 (sagebrush gray-semi-gloss)

A paint chip sample of the specified color will be available from the BLM district office upon request by the operator. Other colors may be specified, if required by a site-specific analysis.

6. Exceptions to these requirements will be allowed, if mutually agreed upon, for: safety as described by the Occupational Safety and Health Administration (OSHA) in part 1910.144, Title 29 of the Code of the Federal Regulations "Safety Color Code for Marking Physical Hazards"; functional identification which might aid in the identification of materials conveyed as described in the American National Standards Institute (ANSI) document A13.1 "Scheme for the Identification of Piping Systems"; or to aid in the functional use of certain types of equipment (i.e., painting equipment a dark color to absorb heat to aid flow of high viscous liquids). All exceptions must be approved by BLM and USGS on a case-by-case basis.

7. If noncompliance is recognized by BLM employees, it should immediately be brought to the attention of the appropriate USGS District Engineer, by letter, stating the specific noncompliance and date observed.



Distribution	DCs - 1
WO (412) - 2	SCs - 1
DSC (D-531) - 3	Gene Daniel, USGS, Albuquerque
SD - 1	District Engineers, USGS
DMS - 1	Regional Forester, USFS, Albuquerque



United States Department of the Interior

GEOLOGICAL SURVEY

P. O. Box 26124
Albuquerque, New Mexico 87125

June 1, 1978

Memorandum

To: District Engineers, Southern Rocky Mountain Area

From: Oil and Gas Supervisor, Southern Rocky Mountain Area

Subject: Painting requirements for oil field equipment and structures

The Bureau of Land Management and the U. S. Geological Survey have previously agreed on the following stipulation that will be attached to new oil and gas leases. This stipulation is attached when the BLM Visual Resource Management program and/or Forest Service's Visual Management System determine that the area to be leased requires the stipulation:

"To maintain esthetic values, all semi-permanent and permanent facilities may require painting or camouflage to blend with the natural surroundings. The paint selection or method of camouflage will be subject to approval by the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management."

This stipulation is general, and does not cover the numerous questions that have developed in implementing painting requirements. Also, there are no guidelines for painting requirements for leases previously issued without the stipulation. Representatives from BLM, USFS, GS and the oil industry have met numerous times to develop some workable guidelines for use on permanent oil field equipment and structures. The following guidelines and procedures are to be effective as of the date of this memorandum:

- I. The USGS concurs with the requirement that oil field equipment and structures may require painting to minimize the visual impact for an area. The equipment and structures that will require painting and the procedures for such painting are outlined below.
- II. The following painting guidelines and procedures apply to all oil field equipment and structures installed after the date of this memorandum. Painting stipulations and requirements previously issued to operators are modified to meet these guidelines and procedures.

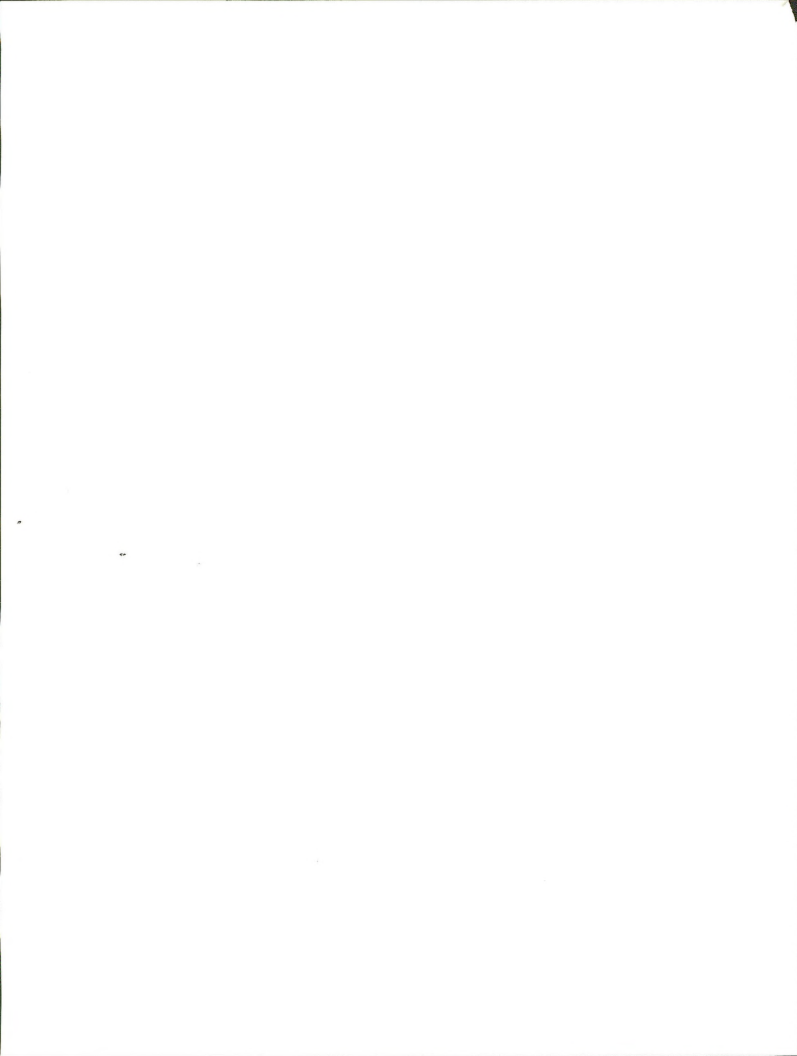
- III. Existing equipment and structures will not be under the painting requirements until such equipment needs repainting. At that time, Geological Survey and the surface managing agency will determine whether the equipment should be painted for visual resource impact using the guidelines and procedures listed below.
- IV. At the pre-drill inspection for a proposed well (attended by representatives of the surface managing agency, Geological Survey and the operator), the painting requirements for that well will be determined. These requirements will be defined at the proposed location on a well-by-well basis. Such painting requirements as agreed to at the field inspection will be included as the painting stipulation attached to the approved Application for Permit to Drill (APD). Geological Survey will enforce these painting requirements along with our regular inspection and supervision of producing and drilling operations.
- V. The following guidelines and procedures are to be used for determining the equipment and structures to be painted under number IV above:
- A. All equipment and structures (except heater treater fireboxes and stacks, small wire or galvanized fencing, and that provided for under B.5. below) that are located within $\frac{1}{4}$ mile of any of the following will be painted:
1. A paved road.
 2. An unpaved road which is well-traveled by non-oil field personnel (at least 50 vehicles per 24 hours).
 3. An officially-designated public use site, observation area, or overlook.
- B. All equipment and structures not covered by A. above will be painted using the following procedures:
1. The initial criteria to be used to determine what should be painted will be the equipment or structures that can be seen one-quarter mile or beyond from the proposed location. The equipment or structures that cannot be seen from this distance should not require painting.

2. As a general rule, all high-level equipment (six feet or higher) such as tanks, separators and heater treaters (except the firebox and stack) will require painting.
3. As a general rule, equipment such as pumping units (the tips of movable parts--such as the horsehead, weights and beam--will be painted according to OSHA requirements), flow lines or other lines on the ground, other small-size lines (4-inch diameter and smaller), low-level well head equipment and headers (up to five feet in height), and small and galvanized wire and pipe that are not normally painted will not require painting. If this type of equipment is normally painted, or painted from previous use, the contrast of color will be considered in visual assessment. It is desirable that as much equipment as possible be painted a uniform blending color if it is going to be painted.
4. Cattleguards and protective piping around equipment adjacent to roads may require painting, but should be conditioned so that they are readily seen both during the day and night to prevent accidents from moving vehicles.
5. Certain equipment and structures may require a specific color paint to prevent loss of hydrocarbon, or to maintain the fluids stored and transported in a fluid state. Some examples of this are light-colored storage tanks to prevent loss of hydrocarbons due to heat, and dark tanks for high pour-point fluids that need additional heat to maintain their fluid state.
6. The use of semi-gloss paint in lieu of flat paint for some colors in certain areas will be acceptable.

The provision for a well-by-well field determination for the painting requirement is not intended to allow USGS personnel to discuss the pros and cons of requiring painting in general, but to provide field input to the painting stipulation that will be attached to the APD.

Paint color numbers and chips have been provided for each district for reference and identification for operators. These numbers and colors will be the same as those used by the surface managing agency.


JAMES W. SUTHERLAND



Appendix B

Part 1

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

Notice to Lessees and Operators of
Federal and Indian Onshore Oil and Gas Leases
(NTL-6)

APPROVAL OF OPERATIONS

In accordance with the National Environmental Policy Act of 1969 (83 Stat. 852), the United States Geological Survey must assure that operations on oil and gas leases under its jurisdiction are conducted with due regard for protection of the environment. All operations which are conducted on onshore Federal and Indian oil and gas leases must conform to the requirements of this Notice as well as those contained in the lease and in the Oil and Gas Operating Regulations, Title 30 CFR Part 221. Operations on Osage Indian oil and gas leases and exploration activities under Title 43 CFR 3045 are not included within the purview of this Notice.

As used in this Notice, the term "District Engineer" means that Officer of the United States Geological Survey who is the head of the District Office supervising operations in the geographic area in which the operation is located. In the State of Alaska, the Area Oil and Gas Supervisor will administer the requirements of this Notice. In some special instances, other Area Oil and Gas Supervisors will act on permit applications.

I. General

In order that the environmental impact of proposed operations may be properly evaluated, all applications to conduct leasehold operations or construction activities must be accompanied by an appropriate surface use plan. As a minimum, such applications and surface use plans must provide a detailed description

of the technical aspects of the proposed operation or activity, the magnitude of surface disturbance involved, and the procedures to be followed in rehabilitating the surface once the operation or construction activity has been completed. Specific requirements in this regard are set forth in Sections II.B., III., and V. hereof. One copy of the surface use plan must be attached to each copy of the application to conduct operations or construction activities.

Applications to conduct operations or construction activities with attached surface use plans should be filed at least 30 days in advance of the contemplated starting date of any operation or construction activity in order to allow sufficient time in which to schedule and conduct, if necessary, a joint field inspection by appropriate personnel of the Geological Survey, the Federal surface management agency, the lessee or operator, and, if practical, the lessee's or operator's contractors and subcontractors who will perform the work. Any interested party who wishes may also attend the field inspection. The early filing of a complete application is no guarantee that approval thereof will be granted within the 30-day period, as environmental considerations or the volume of applications in the affected Federal agencies may result in more than 30-day delay.

All applications will be processed as quickly as possible in all Federal agencies consistent with other work in the offices. In general, the processing of applications will be assigned a high priority and individual applications will be processed according to the date the complete application is filed. A higher priority due to an emergency, such as an imminent lease expiration date, will be duly considered but no special consideration will be given simply because a late filing is made. If it is not possible for Geological Survey action to be taken prior to lease expiration or within 30 days of the filing date, whichever occurs first, the lessee or operator will be advised both orally and in writing. Said advice will detail the reasons for the delay so that the lessee or operator may take such appeal or other recourse as is allowed by law and/or regulation.

Lessees and operators have the responsibility to see that their exploration, development, production, and construction operations are conducted in a manner which (1) results in diligent development and efficient resource recovery; (2) affords adequate safeguards for the environment; (3) results in the proper rehabilitation of disturbed lands; (4) assures the protection of the public health and safety; and, (5) conforms with the best available practice. In that regard, lessees and operators will be held fully accountable for their contractors' and subcontractors' compliance with the requirements of the approved permit and surface use plan.

All approvals of proposed operations as well as subsequent instructions and regulation thereof will be by the District Engineer of the Geological Survey. However, the Federal surface management agency will establish the rehabilitation requirements and will be available for consultation during rehabilitation operations. Names, addresses, and phone numbers of appropriate personnel of the Geological Survey and the Federal surface management agency, as well as approved surface use areas, will be furnished the lessee or operator with its approved copy of the permit and surface use plan.

Lessees and operators, as well as their contractors and subcontractors, must not commence any operation or construction activity on a lease without the prior approval of the appropriate official of the Geological Survey. Said approvals may be oral in emergency situations or in instances such as subsurface plugging programs for newly-drilled dry holes or failures. Any oral approval so received must be followed by a written application and approval thereof for confirmation. Likewise, the terms and conditions of an approved permit and surface use plan may not be altered unless the Geological Survey has approved an amended or supplemental permit and/or plan covering any such modifications. Approval of subsequent operations is addressed in Section V. of this Notice.

II. Drilling Operations

A. Preliminary Environmental Review

A preliminary environmental review is required on all future drilling operations prior to entry on the ground for the purpose of staking the location, access roads, and other surface use areas. The lessee or operator, upon finalizing plans to drill but prior to the actual surveying, must file with the Geological Survey's District Engineer and the appropriate office of the involved Federal surface management agency, a topographic map, or such other map as is acceptable to the District Engineer, scale not less than 1 inch = 1 mile which shows the preferred location and the general topographic features in the area. This will permit the Federal surface management agency, prior to the lessee's or operator's expenditure of time and money for surveys, to review its records for any potential conflicts with other resource values. If conflicts are noted, a joint conference or field inspection, as appropriate, by the Geological Survey, the Federal surface management agency, the lessee or operator, and other interested parties may be scheduled to resolve problem areas. If the lessee or operator has not been advised to the contrary within 15 days from the date of submitting the preliminary map, it may assume that there are no objections to entry on the land for the purpose of required surveying and staking and may proceed accordingly. It is anticipated that the need for a joint field conference and/or inspection prior to staking will be very unusual.

B. Application for Permit to Drill

Drilling operations must not be conducted without a permit which has the prior approval of the District Engineer. Although multiple wells may be covered in a single surface use plan, the application for permit to drill must be submitted on an individual well basis.

The permit application filed for approval will consist of Form 9-331C (Application for Permit to Drill, Deepen, or Plug Back) and a multi-point surface use and operations

plan. Where private surface is involved, it should also include a copy of the written agreement between the lessee or operator and the surface owner, a letter from the lessee or operator setting forth the rehabilitation requirements agreed to with said owner, or a letter stating the reasons why such agreement is not obtainable. The requirements for surface use and operations plans and the rehabilitation of private surface are contained in Sections III. and VI., respectively, of this Notice.

The application for permit to drill must provide information concerning (1) the location, as determined by a registered surveyor, in feet and direction from the nearest section lines of an established public land survey or, in areas where there are no public land surveys, by such other method as is acceptable to the District Engineer; (2) the elevation above sea level of the unprepared ground; (3) the geologic name of the surface formation; (4) the type of drilling tools and associated equipment to be utilized; (5) the proposed drilling depth; (6) the estimated tops of important geologic markers; (7) the estimated depths at which anticipated water, oil, gas, or other mineral bearing formations are expected to be encountered; (8) the proposed casing program including the size, grade, and weight of each string and whether it is new or used; (9) the proposed setting depth of each casing string and the amount and type of cement (including additives) to be used; (10) the lessee's or operator's minimum specifications for pressure control equipment which is to be used, a schematic diagram thereof showing sizes, pressure ratings (or API series), and the testing procedures and testing frequency; (11) the type and characteristics of the proposed circulating medium or mediums to be employed for rotary drilling and the quantities and types of mud and weighting material to be maintained; (12) the testing, logging, and coring programs to be followed with provision made for required flexibility; (13) any anticipated abnormal pressures or temperatures expected to be encountered or potential hazards such as hydrogen sulfide gas, along with plans for mitigating such hazards; (14) the anticipated starting date and duration of the operation; and, (15) any other facets of the proposed operation which the lessee or operator wishes to point out for the Geological Survey's consideration of the application. The District Engineer will require additional information as warranted.

A copy of the approved application for permit to drill and the accompanying surface use and operations plan along with any conditions of approval shall be available to authorized personnel at the drillsite whenever active construction or drilling operations are underway.

III. Multi-Point Surface Use and Operations Plan

A surface use and operations plan in sufficient detail to permit a complete appraisal of the environmental effects associated with the proposed project must be submitted, in triplicate, to the District Engineer with the application for permit to drill.

The Geological Survey will send a copy of such plan to the Federal surface management agency. When possible, a preliminary field development plan or drilling schedule concerning the lessee's or operator's plans for additional development should also be submitted to allow lead time for evaluating environmental considerations, resource conflicts, and land use planning alternatives.

The surface use and operations plan shall, in its context, provide for adequate protection of surface resources, other environmental components, and include adequate measures for rehabilitation of disturbed lands. The plan shall be developed in conformity with the provisions of the lease, attached stipulations, and the guidelines provided by this Notice. In developing the plan, the lessee or operator will make use of such information as is available from the Federal surface management agency concerning the surface resources, environmental considerations, and local rehabilitation procedures. The plan will be reviewed for adequacy by the Geological Survey and the Federal surface management agency. The Geological Survey will act as the lead agency in assessing the effects of the plan. If the plan is considered inadequate, the Geological Survey will, in consultation with the Federal surface management agency, require modification or amendment of the plan or otherwise set forth such stipulations or conditions of approval as are necessary for the protection of surface resources and environment, including rehabilitation of the disturbed areas.

A. Guidelines for the preparation of surface use and operations plan

In the preparation of surface use and operations plans, lessees and operators should submit maps, facility layouts and narrative descriptions which adhere closely to the following:

1. Existing roads. A legible map (USGS topographic, county road map, or such other map as is acceptable to the District Engineer and the Federal surface management agency) shall be used for locating the proposed well site in relation to a town or other locatable reference point. The proposed route to the location including appropriate distances from the reference point to the point where the access route exits the highway or county road shall be shown. All proposed access roads shall be appropriately labeled or color coded. Additionally, all existing roads within a radius of three miles (including information relative to the type of surface, condition, and load capacity) from the location of a proposed exploratory well should be shown. For the purpose of this Notice, an exploratory well is defined as a well which is located two miles or more from the boundary of a Known Geologic Structure (as such term is defined by USGS) or a producible well. For all other drillsites (development wells), existing roads within a one-mile radius of the location should be shown.

Any plans for the improvement and/or maintenance of existing roads should also be stated.

Information required by item Nos. 2, 3, 4, 5, 6, 7, and 9 of this subsection may also be shown on this map if appropriately labeled.

2. Planned access roads. Information in this regard is to be submitted on a map of suitable scale and shall appropriately identify all permanent and temporary access roads that are to be constructed, or reconstructed in connection with the drilling and production of the proposed well. Width,

maximum grade, turnouts, drainage design, location and size of culverts, and surfacing material, if any, shall be stated. At the time of submittal, the center line location of all proposed new or reconstructed roads shall be staked with the stakes being visible from any one to the next. However, modification of proposed road design may be required after the location is accepted for drilling. If the well is completed for production, final road design and construction will depend on the amount and type of hydrocarbon found by the well. Information should also be furnished to indicate where existing fences will be cut and whether gates or cattleguards will be used. Additionally, the discussion should make reference to any existing gates which are to be replaced by cattleguards. Cattleguards which are installed or replaced must be designed to adequately carry anticipated loads.

3. Location of existing wells. This information should be submitted on a map of suitable scale and include all wells (water, abandoned, temporarily abandoned, disposal, and drilling) within a two-mile radius of the proposed location of an exploratory well and all wells (water, producing, abandoned, temporarily abandoned, shut-in, injection, disposal, and drilling) within a one-mile radius of the proposed location of a development well.
4. Location of tank batteries, production facilities, and production, gathering, and service lines. Existing tank batteries, production facilities, and production, gathering, or service lines within a one-mile radius of the proposed location which are owned or controlled by the lessee or operator should be shown on a map or plat of suitable scale. The type of each present facility and the exact nature of each existing line (oil flow line, gas gathering line, injection line, or water disposal line) should be identified and it should be noted which, if any, of said lines are buried. If new facilities (tank battery, other production equipment, and lines) are contemplated in the event production is

established and those facilities are to be located at other than on the well site itself, the map or plat furnished in this regard must also indicate the location of all proposed new facilities. The dimensions of these facilities, the proposed construction methods and materials, and the protective measures and devices to be employed to minimize hazards to livestock, waterfowl, and other wildlife will be stated. The approximate center locations of all production facility locations and the center lines of proposed gathering and service lines will be staked. A plan for rehabilitation of all disturbed areas no longer needed for operations and maintenance will also be submitted. Future prospects for additional development of the leasehold should be considered in the siting of new facilities. However, final approval to construct such new facilities will not be granted until after detailed plans have been submitted and evaluated pursuant to Section V. hereof.

5. Location and type of water supply (rivers, creeks, lakes, ponds, and wells). This information may be shown by quarter-quarter section on a plat or map of suitable scale or may be a written description. The source of all water to be used in drilling the proposed well must be noted if located on Federal or Indian land or if water is to be used from a Federal or Indian project. The method of transporting the water shall be stated, and any access roads crossing Federal or Indian land needed to haul the water will be described in item Nos. 1 or 2, as appropriate. However, the Survey's approval of the surface use and operations plan does not relieve the lessee or operator from obtaining any other authorization which may be required for the use of such water. Moreover, if a water supply well is to be drilled on the lease, it must be so stated under this item, and the District Engineer may require the filing of a separate application for permit to drill.

6. Source of construction materials. This information may be shown by quarter-quarter section on a plat or map of suitable scale or may be a written description. The proposed source (if located on Federal or Indian land), character, and use of all construction materials such as sand, gravel, stone, and soil material should be stated. Any access roads crossing Federal or Indian land needed to haul such materials should be described in item Nos. 1 or 2, as appropriate.
7. Methods for handling waste disposal. A brief, written description should be given of the methods and location proposed for safe containment and disposal of each type of waste material (cuttings, garbage, salts, chemicals, and sewage) which results from the drilling of the proposed well. Likewise, the narrative should include plans for the eventual disposal of drilling fluids and any produced oil or water recovered during testing operations.
8. Ancillary facilities. The plans or subsequent amendments to such plans shall identify all ancillary facilities such as camps and airstrips as to their location, land area required, and the methods and standards to be employed in their construction. Such facilities shall be shown on a map of suitable scale. The approximate center of proposed camps and the center line of airstrips shall be staked on the ground.
9. Well site layout. A plat of suitable scale (not less than 1 inch = 50 feet) including cross section diagrams of the drill pad showing all cuts and fills and the relation to topography are required. The plat should also include the proposed location of the mud tanks, pits (reserve, burn, and trash), pipe racks, access roads, turnaround areas, parking areas, living facilities, soil material stockpiles, and the orientation of the rig with respect to the pad and other facilities. Plans, if any, to line the reserve pit should be indicated.

Until such time as the location is approved, it will be necessary to stake only the actual location of the well.

After approval and before construction commences, the exterior dimensions of the pad and reserve pit will be staked on the ground. The stakes should be appropriately marked to indicate proper cuts and fills to the dirt contractor.

10. Plans for restoration of the surface. State the proposed program for surface restoration upon completion of the operation such as determination of the reshaped topography, drainage system, segregation of spoils materials, surface manipulations, waste disposal, revegetation methods, soil treatments, and amendments, plus other practices necessary to rehabilitate all disturbed areas including any access roads no longer needed. Such plans will be reviewed for adequacy by the appropriate Federal surface management agency. A proposed timetable for the commencement and completion of rehabilitation operations must be provided.
11. Other information. Include a general description of the topography, soil characteristics, formation lithologies, geologic features, flora, fauna, and other aspects of the area such as other surface use activities. The surface ownership (Federal, Indian, State, or private) at the well location and for all lands which are to be crossed by newly constructed or upgraded roads should be indicated.

Any other available information which is considered by the lessee or operator as being useful to the Geological Survey and Federal surface managing agency in evaluating the environmental impact of the proposed operation, including proximity to steep hillsides and gullies, water wells, ponds, lakes, or streams, occupied dwellings, or other facilities, and archeological, historical, or cultural sites, should be included.

Information concerning required cuts and fills during the construction of roads and the location and all construction practices necessary to accommodate potential geologic hazards should be discussed under the appropriate items of the plan.

12. Lessee's or operator's representative. Include the name, address, and phone number of the lessee's or operator's field representative who is responsible for assuring compliance with the approved surface use and operations plan.

13. Certification. The following statement is to be incorporated in the plan and must be signed by the lessee's or operator's field representative who is identified in item No. 12 of the plan:

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drillsite and access route; that I am familiar with the conditions which presently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and, that the work associated with the operations proposed herein will be performed by _____

_____ and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved.

Date

Name and Title

IV. Environmental Analysis Requirements

If a preliminary inspection was not made prior to staking, an onsite inspection will normally be required following the filing of the application for permit to drill. If made, it will include representatives of the District Engineer, the lessee or operator, the Federal surface management agency, and such other interested parties as the lessee's or operator's dirt contractor. The purpose of this inspection will be to select the most feasible and environmentally acceptable areas for well sites (considering geologic factors and Federal and State regulations), access roads, and other proposed surface use areas. Accordingly, lessees and operators are encouraged to designate their future development or drilling sites so that several locations may be inspected at one time.

When such an inspection is made, an Environmental Analysis will usually be prepared by the office of the District Engineer. Said analysis will identify methods for mitigating the potential adverse environmental effects associated with the proposed operation and will be the basis of the approving official's determination as to whether approval of the proposed activity would constitute a major Federal action significantly affecting the quality of the human

environment as defined by Section 102(2)(C) of the National Environmental Policy Act of 1969. Any surface protection and rehabilitation requirements specified by the Federal surface management agency will normally be made a part of any subsequently approved permit and/or the surface use and operations plan.

Due to the probability of an onsite inspection, the required input from other Federal agencies, and the variations in the level of drilling activity, lessees and operators are encouraged to file applications well in advance of the time when it is desired to commence operations.

V. Approval of Subsequent Operations

Before repairing, deepening, or conditioning a well, i.e., work that will involve change in the original or plugged back depth, casing arrangement, and/or present producing interval(s) including separation or commingling, a detailed written statement of the plan of work must be filed on Form 9-331A or 9-331C with the District Engineer and approval obtained before the work is started. Any proposed change in any such plan of work must also receive the prior approval of the District Engineer. Routine well work such as pump, rods, tubing and surface production equipment repairs will not require submittal of Form 9-331A unless specifically required by the District Engineer.

Lessees and operators are also required to submit for the approval of the District Engineer a suitable plan prior to undertaking any subsequent new construction, reconstruction, or alteration of existing facilities, including roads, dams, lines or other production facilities on any lease when additional surface disturbance will result. However, emergency repairs may be conducted without prior approval provided that prompt notification is provided to the District Engineer. Sufficient information must be submitted to permit a proper evaluation of the proposed surface disturbing activities as well as any planned accommodations necessary to mitigate potential adverse environmental effects.

The environmental analysis procedures discussed in Section IV. of this Notice will also apply to such subsequent operations which have the potential for significant surface disturbance although these requirements may be somewhat less in established producing areas.

VI. Agreement for Rehabilitation of Privately-Owned Surface

Where the surface is privately owned or is held in trust for Indian benefit, each application for permit to drill or to conduct other surface disturbance activities, shall contain information concerning the private surface owner's or Indian rehabilitation requirements. A written agreement between the lessee or operator and the surface owner is not necessary if a letter from the lessee or the operator setting forth the surface owner's rehabilitation requirements is furnished. In those cases where it is impossible or impractical to obtain the private surface owner's or Indian rehabilitation requirements, a letter from the lessee or operator describing the situation will be acceptable. Payment of damages in lieu of full restoration will not be an acceptable substitute for a normal cleanup and rehabilitation program.

If no arrangements have been made, or if information concerning such arrangements is not furnished, the District Engineer will request the appropriate Federal agency to recommend the necessary surface restoration requirements. In such cases, the lessee or operator will be expected to comply with these rehabilitation requirements, if any, regardless of the arrangement made with the surface owner. Provided, however, that subsequent reasonable requests by the surface owner that pits, roads, and other facilities be left intact may be honored. If written proof of prior arrangements has been provided, the appropriate Federal agency will be asked to recommend surface rehabilitation requirements to the District Engineer giving full consideration to the preferences of the landowner.

VII. Well Abandonment

No well abandonment operations may be commenced in the absence of the prior approval of the District Engineer. In the case of newly drilled dry holes or failures and in emergency situations, oral approval may be obtained from the District Engineer subject to confirmation by written application. For existing wells not having an approved surface use plan, a sketch showing the disturbed area and roads to be abandoned along with rehabilitation plans must be submitted with the application. However, the Federal surface management agency may request additional surface rehabilitation measures at abandonment and, these requirements are normally made a part of the Geological Survey's approval of abandonment. Upon completion of the abandonment and rehabilitation operations, the lessee or operator should notify the District Engineer

that the location is ready for inspection usually via an additional Sundry Notice. Final abandonment will not be approved until the surface rehabilitation work required by the drilling permit or abandonment notice has been completed and the required vegetation is established to the satisfaction of the appropriate Federal surface management agency.

VIII. Water Well Conversion

The complete abandonment of a well which has encountered usable fresh water will not be approved if the Federal surface management agency wants to acquire the well. If, at abandonment, the Federal surface management agency elects to assume further responsibility for the well, it will reimburse the lessee or operator for the cost of any recoverable casing or well head equipment which it requests to be left in or on the hole solely because it is to be completed as a water well. The lessee or operator will abandon the well to the base of the deepest fresh water zone of interest as required by the District Engineer and will complete the surface cleanup and rehabilitation as required by the drilling permit or abandonment notice immediately upon completion of the conversion operations.

JUN 1 1976

Date

Carl E. Traywick

Oil and Gas Supervisor

Southern Rocky Mountain Area

Approved:

Russell G. Wayland

Russell G. Wayland
Chief, Conservation Division

Appendix B
Part 2

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

Notice to Lessees and Operators
of Federal and Indian Oil and Gas Leases
(NTL-2B)

Disposal of Produced Water

This Notice supersedes NTL-2 and 2A and is issued pursuant to the authority prescribed in 30 CFR 221.4 and 221.32. Lessees and operators of onshore Federal and Indian oil and gas leases or fee and State leases committed to federally supervised unitized or communitized areas shall comply with the following requirements for the handling, storing, or disposing of water produced from oil and gas wells on such leases.

As used in this Notice, the term "District Engineer" means the District Engineer, U.S. Geological Survey. However, in the State of Alaska, the requirements of this Notice will be administered by the Area Oil and Gas Supervisor.

I DISPOSAL REQUIREMENTS AND APPLICATIONS FOR APPROVAL OF DISPOSAL METHODS

By October 1, 1977, all produced water from the above said leases must be disposed of by (1) injection into the subsurface; (2) lined pits; or, (3) by other acceptable methods. All such disposal methods must be approved in writing by the District Engineer regardless of the physical location of the disposal facility. Any method of disposal which has not been approved as of October 1, 1977, will be considered as an incident of noncompliance and will be grounds for issuing a shut-in order until an acceptable manner for disposing of said water is provided and approved by the District Engineer. Lessees and operators are encouraged to file applications in this regard as promptly as possible and are forewarned that applications for approval of existing disposal facilities which are filed after July 1, 1977, may not be timely approved.

No additional approval is required for facilities previously approved by the Geological Survey which involve the disposal of produced water into the subsurface or in lined surface pits. Likewise, no further approval is necessary for existing injection facilities utilized for pressure maintenance or secondary recovery operations.

Lessees and operators who are presently disposing of water in unlined surface pits must timely file applications with the District Engineer for approval of present or proposed disposal methods. Likewise, lessees and operators who are presently disposing of produced water in the subsurface or in lined surface pits without approval of the Geological Survey must also file applications for approval thereof by the District Engineer.

The District Engineer may require modification of any disposal facility prior to October 1, 1977, whenever it is determined that continued use of such facility is endangering the fresh water in the area or is otherwise adversely affecting the environment.

Any application to dispose of produced water must specify the proposed method of disposal and provide the information necessary to justify the method. Required information which must be included in applications for approval of produced water disposal in the subsurface, in lined pits, or in unlined pits is set forth in Sections II, III, and IV, respectively, of this Notice. Additional information may be required by the District Engineer in individual cases. Previous applications filed in response to NTL-2 and NTL-2A which do not meet the data requirements of this Notice must be supplemented or resubmitted.

A single application may be submitted for several leases or facilities provided that (1) the leases or facilities are located in the same field; (2) the produced water is from the same formation or is of similar quality; (3) the volume and source of the water is shown separately for each disposal facility; and, (4) the method of disposal is the same in every case.

II DISPOSAL IN THE SUBSURFACE

If approval is requested for subsurface water injection in connection with secondary recovery operations or for disposal purposes, the lessee or operator must furnish information which includes:

1. The designated name and number of the proposed disposal well and its location in feet and direction from the nearest section lines of an established survey. The applicable Federal or Indian oil and gas lease number or other permit and/or the ownership of the surface and minerals if other than Federal or Indian.
2. The daily quantity and sources of the produced water and a water analysis which includes total dissolved solids, pH, and the concentrations of chlorides and sulfates.
3. The injection formation and interval.
4. The quality of the fluids in the injection interval, i.e., total dissolved solids.
5. The depth and areal extent of all usable water (i.e., less than 10,000 ppm total dissolved solids) aquifers in the area.
6. The size, weight, grade and casing points of all casing strings, the size hole drilled to accommodate each string, the amount and type of cement, including additives used in cementing each string, and the top of the cement behind each casing string. In addition, bond logs may be required in certain instances.
7. The total and plugged back depth of the well.
8. The present or proposed method of completing the well for injection including the type and size of tubing and packer to be utilized, the setting depth of the packer, anticipated injection pressure, and information concerning any corrosion inhibitor fluid which is to be placed in the tubing-casing annulus.
9. Plans for monitoring the system to assure that injection is confined to the injection interval and measures to be taken should it be necessary to shut-in the disposal system.

In order to be approved, subsurface disposal must be confined (1) to formations which contain water of similar or poorer quality than the injected water or (2) to formations that contain water of such poor quality as to eliminate any practical use thereof.

In general, it will be required that subsurface disposal be accomplished through tubing utilizing a packer which is designed to hold pressure from above and below. The packer should be set at a depth where the casing is protected by competent cement but normally not more than 50 feet above the injection interval. Other procedures or methods of subsurface disposal may be approved by the District Engineer when justified by the lessee or operator.

III DISPOSAL IN LINED PITS

Where approval is requested for surface disposal in a lined pit, the lessee or operator must supply information which includes:

1. A topographic map of suitable scale which shows the size and location of pit.
2. The daily quantity, sources of the produced water, and a water analysis which includes the concentrations of chlorides, sulfates, and other constituents which are toxic to animal, plant, or aquatic life.
3. The evaporation rate for the area compensated for annual rainfall.
4. The method for periodic disposal of precipitated solids.
5. The type of material to be used for lining the pit and the method of installation.
6. The method to be employed for the detection of leaks and plans for corrective action should a leak occur in the liner.

The material used in lining pits must be impervious, weather-resistant, and not subject to deterioration when contacted by hydrocarbons, aqueous acids, alkalies, fungi, or other substances likely to be contained in the produced water. Lined pits constructed after the issuance of this Notice must have an underlying gravel-filled sump and lateral system or other suitable devices for the detection of leaks. The District Engineer shall be provided an opportunity to inspect the leak detection system prior to the installation of the pit liner.

IV DISPOSAL IN UNLINED PITS

Surface disposal into unlined pits will not be considered for approval by the District Engineer unless the lessee or operator can show by application that such disposal meets any one or more of the following criteria:

1. The water to be disposed of has an annual weighted average concentration of not more than 5,000 ppm of total dissolved solids, provided that such water does not contain objectionable levels of any constituent toxic to animal, plant, or aquatic life.
2. That all, or a substantial part, of the produced water is being used for beneficial purposes. For example, produced water used for purposes such as irrigation and livestock or wildlife watering shall be considered as being beneficially used.
3. The water to be disposed of is not of poorer quality than the surface or subsurface waters in the area which reasonably might be affected by such disposal or the surface and subsurface waters are of such poor quality as to eliminate any practical use thereof.
4. The volume of water to be disposed of per facility does not exceed five barrels per day on a monthly basis.
5. The specific method of disposal has been granted a surface discharge permit under the National Pollutant Discharge Elimination System (NPDES).

Applications for approval of unlined surface pits pursuant to exception Nos. 1, 2, 3, or 4, above, must include:

1. The daily quantity and sources of the produced water and for exception Nos. 1 through 3, a water analysis which includes total dissolved solids, pH, and the concentrations of chlorides and sulfates.
2. A topographic map of suitable scale which shows the size and location of the pit.
3. The evaporation rate for the area compensated for annual rainfall.
4. The estimated percolation rate based on the soil characteristics under and adjacent to the pit.
5. The depth and areal extent of all usable water (i.e., less than 10,000 ppm total dissolved solids) aquifers in the area.

Where beneficial use is the basis for the application, the justification submitted must contain written confirmation from the user(s) and the water analysis must also include the oil and grease content, temperature, and the concentration of other constituents which are toxic to animal, plant, or aquatic life.

If the application is made on the basis that surface and subsurface fresh waters will not be affected by disposal in an unlined pit, the justification must also include:

1. Analyses of all surface and subsurface waters in the area which might reasonably be affected by the proposed disposal.
2. Maps or plats showing the location of surface waters, fresh water wells, and existing water disposal facilities within two miles of the proposed disposal facility.
3. Reasonable geologic and hydrologic evidence showing that the proposed disposal method will not adversely impact on existing water quality or major uses of such waters; the depth of the shallowest fresh water aquifer in the area and the presence of any impermeable barrier(s).
4. A copy of any State order or other authorization granted as a result of a public hearing which is pertinent to the District Engineer's consideration of the application.

If the application is for disposal pursuant to an NPDES permit, only a topographic map showing the size and location of the pit together with a copy of the approved permit and the most recent "Discharge Monitoring Report" will be required.

V GENERAL REQUIREMENTS FOR PERMANENT SURFACE PITS

Lined and unlined pits approved for water disposal shall:

1. Have adequate storage capacity to safely contain all produced water even in those months when evaporation rates are at a minimum.
2. Be constructed, maintained, and operated to prevent unauthorized surface discharges of water. Unless surface discharge is authorized, no siphon, except between pits, will be permitted.

3. Be fenced to prevent livestock or wildlife entry to the pit, when required by the District Engineer.
4. Be kept reasonably free from surface accumulations of liquid hydrocarbons by use of approved skimmer pits, settling tanks, or other suitable equipment.
5. Be located away from the established drainage patterns in the area and be constructed so as to prevent the entrance of surface water.

VI TEMPORARY USE OF SURFACE PITS

Unlined surface pits may be used for handling or storage of fluids used in drilling, redrilling, reworking, deepening, or plugging of a well provided that such facilities are promptly and properly emptied and restored upon completion of the operations. Mud or other fluids contained in such pits shall not be disposed of by cutting the pit walls without the prior authorization of the District Engineer. Until finally restored, unattended pits must be fenced to prevent access by livestock and wildlife. Unless otherwise specified by the District Engineer, unlined pits may be used for well evaluation purposes for a period of 30 days.

Unlined pits may also be retained as temporary containment pits for use only in an emergency provided such pits have been approved by the District Engineer. Any emergency use of such pits shall be reported to the District Engineer as soon as possible and the pit shall be emptied and the liquids disposed of in an approved manner within 48 hours following its use, unless such time is extended by the District Engineer.

VII DISPOSAL FACILITIES FOR NEW WFLLS

With the approval of the District Engineer, produced water from wells completed after the issuance date of this Notice may be temporarily disposed of into unlined pits for a period up to 90 days. During the period so authorized, an application for approval of the permanent disposal method, along with the required water analysis and other information, must be submitted to the District Engineer. Failure to timely file an application within the time allowed will be considered an incident of noncompliance and will be grounds for issuing a shut-in order until the application is submitted. With the approval of the District Engineer, the disposal method

may be continued pending his final determination. Once the District Engineer has determined the proper method of disposal, the lessee or operator will have until October 1, 1977, or 60 days following receipt of the District Engineer's determination, whichever is the longer, in which to make any changes necessary to bring the disposal method into compliance. However, if the disposal method then employed is endangering the fresh water in the area or otherwise constitutes a hazard to the quality of the environment, the District Engineer will direct prompt compliance with the requirements of this Notice.

VIII UNAVOIDABLE DELAY

A single extension of time not to exceed three months (six months in arctic and subarctic areas) may be granted by the District Engineer where the lessee or operator conclusively shows by application that, despite the exercise of due care and diligence, he has been unable to timely comply with the requirements of the Notice provided that such delay will not adversely affect the environment.

IX REPORTS

All unauthorized discharges or spills from disposal facilities must be reported to the District Engineer in accordance with the provisions of NTL-3.

Beginning October 1, 1978, and thereafter on an annual basis, lessees and operators must submit a report for each facility which includes the total volume disposed of during the reporting period and a current water analysis which provides the same type of information required for approval of the original application. Provided, however, that:

1. Where disposal is approved pursuant to Section IV (4), no annual water analysis will be required.
2. Where disposal is approved pursuant to a NPDES permit, a copy of the required discharge monitoring report may be submitted in lieu of the above annual report.
3. Where a single application was approved for several leases and/or facilities, a composite annual report covering all such leases and facilities may be submitted.

X COMPLIANCE

Compliance with this Notice does not relieve a lessee or operator of the responsibility for complying with more stringent applicable Federal or State water quality laws and regulations, including those which are subsequently promulgated pursuant to the Safe Drinking Water Act (P.L. 92-523), or with other written orders of the Geological Survey.

JAN 1 1976

Date

John Chulitsky

Acting Area Oil and Gas Supervisor

APPROVED:

Russell G. Wayland

Russell G. Wayland
Chief, Conservation Division

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

(Prepared by Howard Gebel & Mike Howard)

BLM Roswell District Office, Roswell, N.M. July 1980

Grasses & Grass-Like Plants

Scientific Name

A

Agropuron inerme
Agropuron smithii
Andropogon gerardi
Andropogon hallii
Aristida adscensionis
Aristida barbata
Aristida divaricata
Aristida fendleriana
Aristida glauca
Aristida hamulosa
Aristida longiseta
Aristida pansa
Aristida purpurea
Aristida wrightii

Beardless Bluebunch Wheatgrass
Western Wheatgrass
Big Bluestem
Sand Bluestem
Sixweeks Threeawn
Harvard Threeawn
Poverty Threeawn
Fendler Threeawn
Blue Threeawn
Hook Threeawn
Red Threeawn
Wooten Threeawn
Purple Threeawn
Wright Threeawn

B

Blepharoneuron tricholepis
Bothriochloa barbinodis
Bothriochloa saccharoides
Bothriochloa springfieldii
Bothriochloa wrightii
Bouteloua aristidoides
Bouteloua barbata
Bouteloua breviseta
Bouteloua curtipendula
Bouteloua eriopoda
Bouteloua gracilis
Bouteloua hirsuta
Bouteloua trifida
Brachiaria ciliatissima
Bromus anomalus
Bromus catharticus
Bromus japonicus
Buchloe dactyloides

Pine Dropseed
Cane Bluestem
Silver Bluestem
Springfield Bluestem
Wright Bluestem
Needle Grama
Sixweeks Grama
Gyp Grama
Sideoats Grama
Black Grama
Blue Grama
Hairy Grama
Red Grama
Fringed Signal Grass
Nodding Brome
Rescuegrass
Japanese Brome
Buffalograss

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

C

Cenchrus pauciflorus
Chloris cucullata
Chloris virgata
Cynodon dactylon
Cyperus onerosus

Mat Sandbur
Hooded Windmill Grass
Showy Chloris, Feather Fingergrass
Bermuda Grass
Flatsedge

D

Digitaria californica (*Trichachne californica*)
Distichlis spicata var. *spicata*

Arizona Cottontop
Inland Saltgrass

E

Echinochloa crusgalli
Enneapogon desvauxii
Eragrostis barrelieri
Eragrostis curtispedicellata
Eragrostis curvula
Eragrostis erosa
Eragrostis megastachya (*cilianensis*)
Eragrostis oxylepis
Eragrostis sessilis
Erioneuron pilosum

Barnyard Grass
Spike Pappus Grass
Mediterranean Lovegrass
Gummy Lovegrass
Weeping Lovegrass
Chihuahua Lovegrass
Stinkgrass
Red Lovegrass
Tumble Lovegrass
Fluffgrass

F

Festuca arizonica
Festuca octoflora

Arizona Fescue
Six-Weeks Fescue

G

Glyceria striata

Fowl Mannagrass

H

Heteropogon contortus
Hilaria belangeri
Hilaria jamesii
Hilaria mutica

Tanglehead
Curlymesquite
Galleta
Tobosa

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

K

Koeleria pyramidata

Junegrass

L

Leptochloa dubia
Leptoloma cognatum
Lycurus phleoides

Green Sprangletop
Fall Witchgrass
Wolftail

M

Muhlenbergia arenacea
Muhlenbergia arenicola
Muhlenbergia emersleyi
Muhlenbergia depauperata
Muhlenbergia minutissima
Muhlenbergia montana
Muhlenbergia monticola
Muhlenbergia pauciflora
Muhlenbergia porteri
Muhlenbergia pungens
Muhlenbergia repens
Muhlenbergia setifolia
Muhlenbergia torreyi
Muhlenbergia wrightii
Munroa squarrosa

Ear Muhly
Sand Muhly
Bullgrass
Six-Weeks Muhly
Least Muhly
Mountain Muhly
Mesa Muhly
Mexican Muhly
Bush Muhly
Sandhill Muhly
Creeping Muhly
Curlyleaf Muhly
Ring Muhly
Spike Muhly
False Buffalograss

O

Oryzopsis hymenoides

Indian Ricegrass

P

Panicum bulbosum
Panicum hallii
Panicum havardii
Panicum hians
Panicum obtusum
Panicum ramisetum
Panicum distichium
Panicum virgatum
Paspalum stramineum
Poa fendleriana

Bulb Panicum
Hall's Panicum
Havard Panicum
Gaping Panicum
Vine Mesquite
Panicum

Switchgrass
Sand Paspalum
Mutton Bluegrass

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

S

Schizachyrium scoparium
Schedonnardus paniculatus
Scleropogon brevifolius
Setaria leucopila (macrostachya)
Sitanion hystrix
Sorghastrum avenaceum
Sorghum halepense
Sporobolus airoides
Sporobolus asper
Sporobolus contractus
Sporobolus crytandrus
Sporobolus flexuosus
Sporobolus giganteus
Sporobolus nealleyi
Sporobolus wrightii
Stipa comata
Stipa lobata
Stipa neomexicana
Stipa tenuissima

Little Bluestem
 Tumblegrass
 Burrowgrass
 Plains Bristlegrass
 Bottlebrush Squirreltrail
 Indiangrass
 Johnsongrass
 Alkali Sacaton
 Tall Dropseed
 Spike Dropseed
 Sand Dropseed
 Mesa Dropseed
 Giant Dropseed
 Gyp Grass, Nealley Dropseed
 Giant Sacaton
 Needle and Thread
 Littleawn Needlegrass
 New Mexico Feathergrass
 Finestem Needlegrass

T

Tridens muticus
Tridens pilosus
Triplasis purpurea

Slim Tridens
 Hairy Tridens
 Purple Sandgrass

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

Trees and Shrubs

Scientific Name

Common Name(s)

A

Acacia constricta
Acacia greggii
Acacia neovernicosa
Acacia wrightii
Amelanchier utahensis
Arbutus xalapensis
Artemisia bigelovii
Artemisia caudata
Artemisia filifolia
Artemisia frigida
Atriplex canescens

Whitehorn Acacia
 Catclaw Acacia, Gregg Catclaw
 Stickleaf Acacia
 Wright Acacia
 Utah Serviceberry
 Texas Madrone
 Bigelow Sagebrush
 Sagewort Sagebrush
 Sand Sagebrush
 Fringed Sagebrush
 Four Wing Saltbrush

B

Baccharis pteronioides
Baccharis salicina
Berberis haematocarpa
Berberis trifoliolata
Brickellia californica
Brickellia laciniata

Yerba de Pasmó
 Bacchris
 Red Barberry
 Algertia
 Californica Brickellbrush
 Splitleaf Brickellbrush

C

Ceanothus greggii
Celtis reticulata
Ceratoides lanata
Chilopsis linearis
Choisya dumosa
Chrysactina mexicana
Chrysothamnus nauseosus
Chrysothamnus pulchellus
Condalia ericoides
Condalia hookeri
Cercocarpus montanus
 var. *glaber*
Croton fruticulosus

Desert Ceanothus
 Netleaf Hackberry
 Winterfat
 Desert Willow
 Starleaf Mexican Orange
 Damianita
 Rubber Rabbitbrush
 Southwest Rabbitbrush
 Javelinabush
 Brasil
 Mountain Mahogany
 Bush Croton

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

D

Dalea formosa
Dalea frutescens

Feather Dalea
Black Dalea

E

Ephedra antisiphilitica
Ephedra aspera
Ephedra torreyana
Ephedra trifurca

Vine Ephedra
Boundary Ephedra
Torrey Ephedra
Longleaf Ephedra

F

Fallugia paradoxa
Flourensia cernua
Forestiera pubescens
Forsellesia spinescens
Fraxinus velutina

Apache Plume
Tarbush
Elbowbush
Spiny Greasebush
Velvet Ash

G

Garrya wrightii

Wright Silk-Tassel

H

Holodiscus discolor

Bush Rock-Spiraea

J

Juglans major
Juglans microcarpa
Juniperus monosperma
Juniperus pinchottii

Arizona Walnut
Mexican Walnut
One Seeded Juniper
Red Berry Juniper

K

Koeberlinia spinosa
Krameria glandulosa
Krameria grayi
Krameria lanceolata

Allthorn
Range Ratany
White Ratany
Trailing Ratany

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

L

Larrea tridentata
Leucophyllum minus
Lippia graveolens
Lonicera albiflora
Lonicera arizonica
Lycium berlandieri

Creosotebush
 Big Bend Silverleaf
 Red Bush
 White Honeysuckle
 Arizona Honeysuckle
 Berlandier Wolfberry

M

Mimosa binuncifera
Mimosa borealis
Mimosa pringeli
Mortonia scabrella

Catclaw Mimosa
 Fragrant Mimosa
 Mimosa
 Rough Mortonia

P

Parthenium incanum
Philadelphus argenteus
Pinus edulis
Pinus ponderosa
Pinus strobiiformis
Poliomintha incana
Populus spp.
Populus tremuloides
Porophyllum scoparium
Prosopis glandulosa
 var. *glandulosa*
Prosopis glandulosa
 var. *torreyi*
Prunus serotina
Pseudocappia arenaria

Mariola
 Silver Mock Orange
 Pinon Pine
 Ponderosa Pine
 Southwestern White Pine
 Hoary Rosemary Mint
 Cottonwood
 Quaking Aspen

 Honey Mesquite

 Western Honey Mesquite

 Blackcherry
 Sand Clappia Bush

Q

Quercus gambellii
Quercus havardii
Quercus muhlenbergii
Quercus undulata

Gambel Oak
 Shinnery
 Chinkapin Oak
 Wavyleaf Oak

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

R

Rhus aromatica (trilobata)
Rhus lanceolata
Rhus microphylla
Rhus virens
Robinia neomexicana
Rosa stellata
Rosa woodsii

Skunkbush Sumac
 Flameleaf Sumac
 Little Leaf Sumac
 Evergreen Sumac
 New Mexico Locust
 Desert Rose
 Wood Rose

S

Salix goodingii
Salvia lycioides
sapindus saponaria
 var. *drummondii*
sophora secundiflora

Gooding Willow
 Canyon Sage
 Soapberry
 Texas Mountain Laurel, Mescalbean

T

Tamarix ramosissima
trixis californica

Salt Cedar
 California Trixis

U

Ulmus pumila

Chinese Elm

V

Viguiera dentata
Viguiera stenoloba

Sunflower Goldeneye
 Skeletonleaf Goldeneye

X

Xanthocephalum sarothrae

Snakeweed, Broomweed,
 Turpentine-weed

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

Cacti, Succulents and Ferns

Scientific Name

Common Name(s)

A

Agave lecheguilla
Agave neomexicana

Lecheguilla
New Mexico Agave

C

Cheilanthes feei
Cheilanthes tomentosa
Coryphantha macromeris
Coryphantha sneedii
 var. *leei*
Coryphantha strobiliformis
 var. *strobiliformis*

Fee Lipfern
Fendler Lipfern
Big Nipple Cory Cactus
Lee Pincushion Cactus

Cobb Cactus

D

Dasyllirion leiophyllum

Sotol

E

Echinocactus horizontalis
Echinocactus texensis
Echinocereus kuenzleri
Echinocereus pectinatus
 var. *neomexicanus*
Echinocereus pectinatus
 var. *pectinatus*
Echinocereus reichenbachii
Echinocereus stramineus
Echinocereus triglochidiatus
Epithelantha micromeris

Eagle Claw Cactus
Horsecripler
Kuenzler Hedgehog Cactus
Rainbow Cactus

Rainbow Cactus

Lace Echinocereus
Strawberry Pitaya
Claret Cup
Button Cactus

F

Fouquieria splendens

Ocotillo

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

M

Mammillaira gummifera
Mammillaira lasiocarpa

Biznaga de Chilitos
Fuzzy Mammillaria

N

Nolina micrantha
Nolina microcarpa
Notholaena sinuata
var. *cochisensis*

Smallseed Nolina
Sacahuista, Beargrass
Jimmy Fern

O

Opuntia acanthocarpa
Opuntia davisii
Opuntia engelmannii
Opuntia imbricata
Opuntia leptocaulis

Buckhorn Cholla
Davis Cholla
Engelmann Prickley Pear
Walking Stick Cholla
Tasajilla

Y

Yucca baccata
Yucca glauca
Yucca torreyi

Banana Yucca, Datil Yucca
Soaptree Yucca
Spanish Dagger, Torrey Yucca

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

Forbs

Scientific Name

Common Name(s)

A

Abronia angustifolia
Abronia fragrans
Abutilon incanum
Abutilon sonora
Abutilon Parvulum
Acleisanthes longiflora
Acleisanthes obtusa
Agoseris spp.
Allionia incarnate
Allium drummondii
Allium geyeri
Allium macropetalum
Allium perdulce
Ambrosia artemisiifolia
Ambrosia confertifolia
Ambrosia grayi
Ambrosia psilostachya
Anhennoria marginata
Anthericum torreyi
Anulocaulis gypsogenus
Aphanostiphus ramosissimus
Apium graveolens
Argemone chisosensis
Argemone sanguinea
Argythamnia humilis
Argythamnia neomexicana
Asclepias arenaria
Asclepias asperula
Asclepias branchystephana
Asclepias engelmannia
Asclepias involucrata
Asclepias latifolia
Asclepias oenotheroides
Asclepias subverticillata
Asclepias tuberosa
Asclepias viridis
Astragalus mollissimus

Purple Sandverbena
 Snowball Sandverbena
 Indian Mallow

 Little Leaf Abutilon
 Angels Trumpet

 Mountain Dandelion
 Trailing Allionia
 Drummond Onion
 Geyer Onion
 Large Flower Onion
 Onion
 Common Ragweed
 Cluster Ragweed
 Gray Ragweed
 Western Ragweed

 Torrey Anthericum
 Gyp Ringstem
 Plains Posedaisy
 Wild Cherry
 Chisos Pricklepoppy
 Spiny Pricklepoppy
 Wild Mercury
 Wild Mercury
 Sand Milkweed
 Spider Antelopehorn
 Shortcrown Milkweed
 Engelmann Milkweed
 Dwarf Milkweed
 Leaf Milkweed
 Hierba Dezizotes
 Horsetail Milkweed
 Butterfly Milkweed
 Antelopehorn
 Woolly Loco

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

B

<i>Bahia pedata</i>	Bluntscale Bahia
<i>Baileya multiradiata</i>	Desert Bailey
<i>Berlandiera lyrata</i>	Lyreleaf Greeneyes
<i>Boerhaavia linearifolia</i>	Narrowleaf Spiderling
<i>Boerhaavia scandans</i>	Spiderling
<i>Boerhaavia torreyana</i>	Torrey Spiderling

C

<i>Calylophus drummondianus</i> var. <i>drummondianus</i>	Evening Primrose
<i>Calylophus hartwegii</i>	Evening Primrose
<i>Calylophus hartwegii</i> var. <i>fendleri</i>	Evening Primrose
<i>Calylophus hartwegii</i> var. <i>filifolius</i>	Evening Primrose
<i>Calylophus serrulatus</i>	Evening Primrose
<i>Camelia microcarpa</i>	False Flax
<i>Campanula rotundifolia</i>	Bluebell
<i>Carlowrightia torreyana</i>	Torrey Carlowright
<i>Cassia bauhinoidea</i>	Shrubby Senna
<i>Cassia roemeriana</i>	Roemer's Senna
<i>Castilleja integra</i>	Wholeleaf Paintbrush
<i>Castilleja latebracteata</i>	Broadbract Paintbrush
<i>Castilleja sessiliflora</i>	Down Paintbrush
<i>Centaurea americana</i>	American Basketflower
<i>Centaurea picris</i>	
<i>Centaurium calycosum</i>	Buckley Centaurium
<i>Chamaesaracha coniodes</i>	False Nightshade
<i>Chamaesaracha coronopus</i>	Green False Nightshade
<i>Chamaesaracha crenata</i>	
<i>Chamaesaracha edwardsiana</i>	
<i>Chamaesaracha pallida</i>	
<i>Chamaesaracha villosa</i>	Woolly False Nightshade
<i>Chenopodium incanum</i>	Nealy Goosefoot
<i>Cirsium ochrocentrum</i>	Yellow Spine Thistle
<i>Cirsium undulatum</i>	Wavyleaf Thistle
<i>Citrullus vulgaris</i>	Watermelon
<i>Cladium jamaicense</i>	Jamaica Jawgrass
<i>Clematis filifera</i>	Virgin's Bower
<i>Clematis drummondii</i>	Old Man's Beard
<i>Cnidoscolus texanus</i>	Texas Bullnettle
<i>Coldenia canescens</i>	Gray Coldenia
<i>Coldenia hispidissima</i>	Rough Coldenia, Gyp Weed
<i>Comandra pallida</i>	Bastard Toad Flax
<i>Commelina erecta</i> var. <i>angustifolia</i>	Erect Dayflower

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

C

Convolvulus equitans
Conyza canadensis
Conyza coulteri
Corydalis aurea
Croton dioicus
Croton glandulosus
Croton monosperma
Croton parksii
Croton pottsii
Croton texensis
Cryptantha albida
Cryptantha angustifolia
Cryptantha jamesii
Cryptantha mexicana
Cucurbita foetidissima
Cuscuta spp.
Cycloma atriplicifolium

Bindweed
 Horsetail Conyza
 Coulter Conyza
 Golden Corydalis
 Grassland Croton
 Lindheimer Croton
 One Seed Croton

 Leatherweed Croton
 Texas Croton, Doveweed
 Dentnut Cryptanth
 Bristlelobe Cryptanth
 James Cryptanth
 Mexican Cryptanth
 Buffalogourd
 Dodder
 Tumble Ringweed

D

Dalea jamesii
Dalea lanata
Dalea nana
Dalea pogonathera
Datura quercifolia
Delphinium virens
 var. *woottonii*
Descurainia pinnata
Desmanthus velutinus
Dithyrea wislizenii
Draba cuneifolia
Dyschoriste decumbens
Dyschoriste linearis
Dyssodia acerosa
Dyssodia papposa
Dyssodia pentachaeta
 var. *pentachaeta*
Dyssodia setifolia

James Dalea
 Wooley Dalea
 Dwarf Dalea
 Bearded Dalea
 Oakleaf Datura, Jimsonweed
 Plains Larkspur

 Tansey Mustard
 Velvet Bundleflower
 Spectaclepod
 Wedgeleaf Draba
 Spreading Dyschoriste
 Narrowleaf Dyschoriste
 Frickleaf Dogweed
 Mayweed Dogweed
 Common Dogweed

 Gregg Dogweed

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

E

<i>Engelmannia pinnatifida</i>	Engelmann Daisy
<i>Equisetum kansanum</i>	Kansas horsetail
<i>Erigeron bellidiastrium</i>	Western Fleabane
<i>Erigeron modestus</i>	Plains Fleabane
<i>Eriogonum abertianum</i>	Abert Wildbuckwheat
<i>Eriogonum annuum</i>	Annual Buckwheat
<i>Eriogonum gypsophilum</i>	Gypsum Buckwheat
<i>Eriogonum havardii</i>	Havard Wildbuckwheat
<i>Eriogonum hieracifolium</i>	Hawkweed Wildbuckwheat
<i>Eriogonum jamesii</i>	James Wildbuckwheat
<i>Eriogonum polycladon</i>	Sorrel Wildbuckwheat
<i>Eriogonum rotundifolium</i>	Roundleaf Wildbuckwheat
<i>Erodium cicutarium</i>	Filaree
<i>Erodium texanum</i>	Texas Filaree
<i>ERysimum capitatum</i>	
<i>Euphorbia acuta</i>	Pointed Euphorbia
<i>Euphorbia albomarginata</i>	White Margin Euphorbia
<i>Euphorbia dentata</i>	Toothed Euphorbia
<i>Euphorbia fendleri</i>	Fendler Euphorbia
<i>Euphorbia hexagona</i>	Six Angle Euphorbia
<i>Euphorbia lata</i>	Hoary Euphorbia
<i>Euphorbia missurica</i>	Missouri Euphorbia
<i>Euphorbia serrula</i>	Sawtooth Euphorbia
<i>Evax verna</i>	Manystem Evax
<i>Evolvulus pilosus</i>	Hairy Evolvulus

F

<i>Froelichia arizonica</i>	Arizona Snakecotton
<i>Froelichia floridana</i>	Florida Snakecotton

G

<i>Gaillardia multiceps</i>	Gaillardia
<i>Gaillardia pinnatifida</i>	Slender Gaillardia
<i>Gaillardia pulchella</i>	Indian Blanket
<i>Galactia</i> spp.	Milkpea
<i>Galium mexicanum</i>	
<i>Galium microphyllum</i>	Bracted Bedstraw
<i>Gaura coccinea</i>	Scarlet Gaura
<i>Gaura villosa</i> var. <i>arenicola</i>	Sand Gaura
<i>Grindelia aphanactis</i>	Mountain Gumweed
<i>Grindelia squarrosa</i> var. <i>nuda</i>	Rayless Gumweed

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

H

<i>Haploesthes greggii</i>	False Broomweed
<i>Happlopappus spinulosus</i>	Cutleaf Goldenweed
<i>Hedeoma costatum</i>	
<i>Hedeoma drummondii</i>	Drummond Hedoma
<i>Hedyotis acerosa</i>	Needleleaf Bluets
<i>Hedyotis humifusa</i>	Mat Bluets
<i>Hedyotis nigricans</i>	Prairie Bluets
<i>Helianthus ciliaris</i>	Blueweed Sunflower
<i>Helianthus petiolaris</i>	Prairie Sunflower
<i>Heliotropium convolvulaceum</i>	Bindweed Heliotrope
<i>Heliotropium curassavicum</i>	Salt Heliotrope
<i>Heliotropium greggii</i>	Gregg Heliotrope
<i>Hoffmanseggia drepanocarpa</i>	Sicklepod Rushpea
<i>Hoffmanseggia glauca</i>	Indian Rushpea
<i>Hoffmanseggia jamesii</i>	James Rushpea
<i>Hoffmanseggia oxycarpa</i>	Sharppod Rushpea
<i>Hybanthus verticillatus</i>	Whorled Nodviolet
<i>Hymenopappus filifolius</i>	Fineleaf Woollywhite
<i>Hymenopappus flavescens</i> var. <i>canotomentosus</i>	Woollywhite
<i>Hymenopappus flavescens</i> var. <i>flavescens</i>	Yellow Woollywhite
<i>Hymenoxys acaulis</i>	Stemless Hymenoxys
<i>Hymenoxys linearifolia</i>	
<i>Hymenoxys odorata</i>	Western Bitterweed
<i>Hymenoxys richarsoni</i>	Pingue Bitterweed
<i>Hymenoxys scaposa</i> var. <i>villosa</i>	

I

<i>Ibervillea lindheimeri</i>	Lindheimer Globeberry
<i>Ibervillea tenuisecta</i>	Slimlobe Globeberry
<i>Ipomoea leptophylla</i>	Bush Morning Glory
<i>Ipomopsis laxiflora</i>	Iron Ipomopsis
<i>Ipomopsis longiflora</i>	Whiteflower Ipomopsis
<i>Ipomopsis wirghtii</i>	Leafy Ipomopsis

K

<i>Kallstroemia californica</i>	California Caltrop
<i>Kallstroemia grandiflora</i>	Orange Caltrop
<i>Kallstroemia parviflora</i>	Warty Caltrop
<i>Kochia scoparia</i>	Belvedere Summercypress

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

L

<i>Lactuca serriola</i>	Prickly Lettuce
<i>Lappula redowskii</i>	Flatspine Stickseed
<i>Lepidium densiflorum</i>	Prairie Pepperweed
<i>Lepidium lasiocarpum</i>	Hairyrod Pepperweed
<i>Lepidium montanum</i> var. <i>angustifolium</i>	Mountain Pepperweed
<i>Lepidium virginicum</i>	Virginia Pepperweed
<i>Lesquerella argyraea</i>	Silvery Bladderpod
<i>Lesquerella fendleri</i>	Fendler Bladderpod
<i>Lesquerella gordonii</i>	Gordon Bladderpod
<i>Lesquerella gracilis</i> var. <i>gracilis</i>	Lax Bladderpod
<i>Lesquerella ovalifolia</i>	Roundleaf Bladderpod
<i>Leucelene ericoides</i>	Babywhite Aster
<i>Leatris punctata</i> var. <i>mucronata</i>	Dotted Gayfeather
<i>Limonium limbatum</i>	California Sealavender
<i>Linum aristatum</i>	Awned Flax
<i>Linum australe</i>	Flax
<i>Linum lewisii</i>	Lewis Flax
<i>Linum pratense</i>	Meadow Flax
<i>Linum rigidum</i> var. <i>rigidum</i>	Stiffstem Flax
<i>Linum vernale</i>	Spring Flax
<i>Lithospermum incisum</i>	Narrowleaf Gromwell
<i>Lithospermum multiflorum</i>	Manyflower Gromwell
<i>Lithospermum viride</i>	Green Gromwell
<i>Lygodesmia texana</i>	Texas Skeletonplant

M

<i>Machaeranthera blephariphylla</i>	
<i>Machaeranthera linearis</i>	
<i>Machaeranthera parviflora</i>	
<i>Machaeranthera scabrella</i>	
<i>Machaeranthera tanacetifolia</i>	Tahoka Daisy
<i>Marrubium vulgare</i>	Common Horehound
<i>Maurandya antirrhiniflora</i>	Snapdragon Vine
<i>Melannopodium cinereum</i> var. <i>cinereum</i>	Hoary Blackfoot
<i>Melannopodium</i>	Blackfoot Daisy
<i>Menodora longiflora</i>	Showy Menodora
<i>Mendora scabra</i>	Rough Twinpod
<i>Mentzelia humilis</i>	
<i>Mentzelia multiflora</i>	Desert Stickleaf
<i>Mentzelia oligosperma</i>	Chicken Thief
<i>Mentzelia strictissima</i>	Sand Stickleaf
<i>Mirabilis albida</i>	White Four O'Clock
<i>Mirabilis linearis</i>	Four O'Clock
<i>Mirabilis multiflora</i>	Colorado Four O'Clock
<i>Mollugo verticillata</i>	Carpetweed
<i>Monarda pectinata</i>	Plains Beebalm
<i>Monarda punctata</i>	Spotted Beebalm

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

N

Nama hispidum
Nama stevensii
Nerisyrenia camporum
Nerisyrenia linearifolia
Nicotiana trigonophylla
Nyctaginia capitata

Rough Nama
 Stevens Nama
 Mesa Greggia
 Narrowleaf Greggia
 Desert Tobacco
 Scarlet Muskflower

O

Oenothera albicaulis
Oenothera brachycarpa
Oenothera caespitosa
Oenothera engelmannii

Pale Evening Primrose
 Shortpod Evening Primrose
 Tuffed Evening Primrose
 Engelman Evening Primrose

P

Palafoxia rosea var. *macrolepis*
Palafoxia sphacelata
Paronychia jamesii
Parthenium confertum
Pectis papposa
Pectis spp.
Penstemon abiguus
Penstemon brevibarbatulus
Penstemon buckleyi
Penstemon fendleri
Perezia nana
Perezia wrightii
Phacelia integrifolia
Phacelia intermedia
Phacelia popei
Phlox mesoleuca
Phlox triovulata
Phyllanthus polygonoides
Physalis lobata
Physalis viscosa var. *cinerascens*
Plantago insularis
Plantago lanceolata
Plantago patagonia
Plantago wrightiana
Polansia dodecandra
Polansia jamesii
Polygala alba
Polygala longa
Polygala macradenia
Polygala obscura
Polygala scoparioides
Polygala tweedyi
Polygonum aviculare

Rose Palafoxia
 Rayed Palafoxia
 James Nailwort
 Lyreleaf Parthenium
 Chinchweed

 Gilia Penstemon
 Penstemon
 Buckly Penstemon
 Fendler Penstemon
 Desert Holly
 Pink Perezia
 Gyp Bluecurls

 Pope Phacelia
 White-eye phlox
 Threeseed phlox
 Knotweed Leafflower
 Purple Groundcherry
 Waterfall Groundcherry
 Desert Indianwheat
 Buckhorn Plaintain
 Woolly Plaintain
 Wright Plaintain
 Clammyweed
 Clammyweed
 White Milkwort
 Narrowleaf Milkwort
 Glandleaf Milkwort
 Veilseed Milkwort
 Broom Milkwort
 Rock Milkwort
 Prostrate Knotweed

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

Portulaca mundula
Portulaca oleracea
Proboscidea sabulosa
Pseudocymopterus montanus
Psilostrophe tagetina
Psilostrophe villosa
Psoralea tenuiflora

Purslane
 Common Purslane
 Devil's Claw
 Mountain Parsley
 Woolly Paperflower
 Hairy Psilostrophe
 Slimleaf Scurfpea

R

Ranunculus scleratus
Ratibida columnaris
Ratibida tagetes
Reverchonnia avemaria
Rhynchosia texana
Rumex hymenosepalus

Blister Buttercup
 Prairie Coneflower
 Shortray Coneflower
 Sand Reverchonnia
 Texas Snoutbean
 Canaigre

S

Salsola kali
Salvia farinacea
Salvia reflexa
Sanvitalia abertii
Sartwellia flaveriae
Scutellaria drummondii
Schrankia nattalii
Schrankia occidentalis
Schoenocaulon texanum
Selenocarpus diffusus
Senecio douglasii
Senecio longilobus
Senecio neomexicana
Senecio warnockii
Senecio wootonii
Sida filicaulis
Sida physocalyx
Silene laciniata
Sisymbrium ensigerum
Sisymbrium irio
Sisymbrium linearifolium
Similacina racemosa
Solanum eleagnifolium
Solanum rostratum
Solidago altissima
Solidago wrightii
Sonchus asper
Sphaeralcea angustifolia
Sphaeralcea coccinea var. *coccinea*

Russian Thistle, Tumbleweed
 Mealy Sage
 Rockymountain Sage
 Abert Sanvitalia
 Threadleaf Sartwellia
 Drummond Skullcap
 Catclaw Sensitivebriar
 Western Sensitivebriar

 Spreading Moonpod

 Threadleaf Groundsel

 Warnock Groundsel

 Spreading Sida

 Mexican Silene

 Rocketmustard

 Feather Solomoplume
 Silverleaf Nightshade
 Buffalo Bur
 Tall Goldenrod
 Wright Goldenrod
 Prickly Sawthistle
 Narrowleaf Globemallow
 Scarlet Globemallow

Appendix C

TERRESTRIAL PLANTS OF THE ROSWELL DISTRICT

Sphaeralcea hastulata
Sphaeralcea laxa
Stenandrium barbatum
Stephanomeria pauciflora
Stephanomeria wrightii
Stillingia sylvatica
Swertia radiata

Spear Globemallow
 Caliche Globemallow
 Shaggy Stenandrium
 Desert Stephanomeria
 Wright Stephanomeria
 Queen's Delight
 Deer Ears

T

Talinum aurantiacum
Taraxacum officinale
Tetradlea coulteri
Teucrium cubense
Teucrium laciniata
Thamnosma texana

Thelesperma longipes
Thelesperma megapotaemicum
Tidestromia languinosa var. *languinosa*
Townsendia exscapa
Tragia amblyodonta
Tragia ramosa
Tribulus terrestris

Orange Flameflower
 Dandelion

 Small Coast Germander
 Germander
 Texas Desertrue, Dutchman's
 Britches
 Longstalk Greenthread
 Slender Greenthread
 Wolly Tidestromia
 Stemless Townsendia
 Dogtooth Noseburr
 Branching Noseburr
 Goathead, Puncture Vine

V

Verbascum thapsus
Verbena bipinnatifida
Verbena bracteata
Verbena hastata
Verbena neomexicana
Verbena plicata
Verbena wrightii
Verbesina enceloides
Verbesina nana
Vicia americana

Flannel Mullein
 DAKota Verbena
 Big Bract Verbena
 Blue Verbena
 New Mexico Verbena
 Dregener Verbena
 Wright Verbena
 Golden Crownbeard
 Dwarf Crownbeard
 American Vetch

X

Xanthium spinosum
Xanthium strumarium
Xanthocephalum dracunculoides

Spiny Cocklebur
 Abrojo
 Common Broomweed

Z

Zephyranthes longifolia
Zinnia acerosa
Zinnia grandiflora

Copper Zephyrilly
 Spinyleaf Zinnia
 Plains Zinnia

Appendix D

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

(Source: East Roswell Grazing EIS and Run Wild Program, 1979.)

CLASS OF ANIMAL	COMMON NAME	CLASS OF ANIMAL	COMMON NAME
RIPARIAN HABITAT			
Amphibians	Tiger Salamander	Birds (continued)	Cinnamon Teal
	Eastern Barking Frog		Green-winged Teal
	Couch's Spadefoot Toad		Wood Duck
	Western Spadefoot Toad		Readhead
	Plains Spadefoot Toad		Canvasback
	Woodhouse's Toad		Ring-necked Duck
	Great Plains Toad		Lesser Scaup
	Texas Toad		Common Goldeneye
	Green Toad		Bufflehead
	Red-Spotted Toad		White-winged Scoter
	Blanchard's Cricket Frog		Ruddy Duck
	Leopard Frog		Common Merganser
	Bullfrog		Hooded Merganser
			Shoveler
			Lesser Sandhill Crane
Reptiles	Snapping Turtle		Virginia Rail
	Yellow Mud Turtle		Sora
	Painted Turtle		Common Gallinule
	Cooter Turtle		American Coot
	Pond Slider		Purple Gallinule
	Crested Earless Lizard		American Avocet
	Tree Lizard		Black-necked Stilt
	Great Plains Skink		Black-bellied Plover
	Many-lined Skink		Snowy Plover
	Western Whiptail		Semipalmated Plover
	Ringneck Snake		Killdeer
	Coachwhip		Common Snipe
	Corn Snake		Long-billed Curlew
	Bull or Copper Snake		Upland Plover
	Common Kingsnake		Spotted Sandpiper
	Blotched Plain-bellied Water Snake		White-rumped Sandpiper
	Common Garter Snake		Solitary Sandpiper
	Black-necked Garter Snake		Willet
	Checkered Garter Snake		Greater Yellowlegs
	Puget Western Ribbon Snake		Lesser Yellowlegs
	Plains Black-headed Snake		Saunders' Sandpiper
	Western Black-headed Snake		Least Sandpiper
	Western Diamondback Rattlesnake		Dunlin
	Mottled Rock Rattlesnake		Long-billed Dowitcher
	Western Rattlesnake		Sprig Sandpiper
Birds	Common Loon		Western Sandpiper
	Western Grebe		Marbled Godwit
	Eared Grebe		Sanderling
	Pied-billed Grebe		Pectoral Sandpiper
	Horned Grebe		Wilson's Phalarope
	White Pelican		Northern Phalarope
	Double-crested Cormorant		Herring Gull
	Wood Ibis		Ring-billed Gull
	White-faced Ibis		Franklin's Gull
	Common Egret		Somerset Gull
	Snowy Egret		Forster's Tern
	Great Blue Heron		Least Tern
	Little Blue Heron		Black Tern
	Green Heron		Sabine Gull
	Louisiana Heron		Turkey Vulture
	Black-crowned Night Heron		Mississippi Kite
	American Bittern		Coshoek
	Least Bittern		Cooper's Hawk
	Whistling Swan		Sharp-shinned Hawk
	Canada Goose		Mourning Dove
	White-fronted Goose		Rough-legged Hawk
	Snow Goose		Ferruginous Hawk
	Ross' Goose		Red-tailed Hawk
	Blue Goose		Swinson's Hawk
	Mallard		Harrier's Hawk
	Pintail		Golden Eagle
	Gadwall		Bald Eagle
	American Widgeon		Osprey
	Blue-winged Teal		Prairie Falcon
			Martin
			Kestrel

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

CLASS OF ANIMAL	COMMON NAME	CLASS OF ANIMAL	COMMON NAME
Birds (Continued)	Peregrine Falcon Scaled Quail Ring-Necked & White Winged Pheasant Band-tailed Pigeon Rock Dove or Domestic Pigeon White-winged Dove Mourning Dove Inca Dove Ground Dove Yellow-billed Cuckoo Roadrunner Barn Owl Screech Owl Great Horned Owl Burrowing Owl Long-eared Owl Short-eared Owl Spotted Owl Poor-Will Common Nighthawk Lesser Nighthawk Chimney Swift White-throated Swift Black-chinned Hummingbird Broad-tailed Hummingbird Rufous Hummingbird Belted Kingfisher Yellow-shafted Flicker Red-shafted Flicker Red-headed Woodpecker Yellow-bellied Sapsucker Williamson's Sapsucker Ladder-backed Woodpecker Eastern Kingbird Western Kingbird Cassin's Kingbird Scissor-tailed Flycatcher Ash-throated Flycatcher Eastern Phoebe Black Phoebe Say's Phoebe Traill's Flycatcher Western Flycatcher Western Wood Pewee Olive-sided Flycatcher Vermilion Flycatcher Violet Green Swallow Tree Swallow Bank Swallow Rough-winged Swallow Cliff Swallow Barn Swallow Mockingbird Cuckbird Brown Thrasher Curve-billed Thrasher Crissal Thrasher Sage Thrasher Steiler's Jay Scrub Jay Common Raven White-necked Raven Plain Titmouse Verdin Common Bushtit Dipper White-breasted Nuthatch Red-breasted Nuthatch Pygmy Nuthatch Brown Creeper House Wren Winter Wren Bewick's Wren Cactus Wren Long-billed Marsh Wren Rock Wren Robin Hermit Thrush	Birds (Continued)	Eastern Bluebird Western Bluebird Mountain Bluebird Townsend's Solitaire Golden-crowned Kinglet Ruby-crowned Kinglet Water Pipit Bohemian Waxwing Cedar Waxwing Phainopepla Loggerhead Shrike Starling Bell's Vireo Solitary Vireo Warbling Vireo Orange-crowned Warbler Virginia's Warbler Nashville Warbler Yellow Warbler Myrtle Warbler Audubon's Warbler Black-throated Gray Warbler Townsend's Warbler Kentucky Warbler MacGillivray's Warbler Wilson's Warbler Yellowthroat Yellow-breasted Chat American Redstart House Sparrow Eastern Meadowlark Western Meadowlark Yellow-headed Blackbird Red-winged Blackbird Orchard Oriole Hooded Oriole Scott's Oriole Bullock's Oriole Brewer's Blackbird Boat-tailed Grackle Brown-headed Cowbird Western Tanager Summer Tanager Cardinal Pyrrhuloxia Rose-breasted Grosbeak Black-headed Grosbeak Indigo Bunting Lazuli Bunting Painted Bunting Evening Grosbeak Blue Grosbeak House Finch Pine Siskin American Goldfinch Lesser Goldfinch Red Crossbill Green-tailed Towhee Rufous-sided Towhee Brown Towhee Lark Bunting Savannah Sparrow Grasshopper Sparrow Lark Sparrow Black-throated Sparrow Sage Sparrow Slate-colored Junco Oregon Junco Gray-headed Junco Chipping Sparrow Clay-colored Sparrow Brewer's Sparrow Field Sparrow Harris' Sparrow White-crowned Sparrow Golden-crowned Sparrow White-throated Sparrow Fox Sparrow

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

CLASS OF ANIMAL	COMMON NAME
Birds (Continued)	Lincoln's Sparrow Song Sparrow Dickcissel
Mammals	Leafnose Bat Cave Myotis Long-legged Myotis California Myotis Western Pipistrel Townsend's Big-eared Bat Pallid Bat Brazilian Freetail Bat Big-freetail Bat Pocketed Freetail Bat Raccoon Ringtail Longtail Weasel Spotted Skunk Stripped Skunk Hognose Skunk Coyote Gray Fox Bobcat Plains Pocket Gopher Silky Pocket Mouse Hispid Pocket Mouse Bannertail Kangaroo Rat Ord's Kangaroo Rat Merriam's Pocket Mouse Beaver Western Harvest Mouse White-footed Mouse Deer Mouse Brush Mouse Whitethroat Woodrat (Packrat) Southern Plains Woodrat (Packrat) Hispid Cotton Rat Muskrat Norway Rat House Mouse Porcupine Blacktail Jackrabbit Desert Cottontail Mule Deer Armadillo

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

SPECIES	SPECIES	SPECIES
<u>DRAINAGES, DRAWS, CANYON HABITAT</u>		
<u>FISH</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Bigscale Logperch	Coopers' Hawk	Grey Shrew
Black Bullhead	Red-tailed Hawk	Raccoon
Channel Catfish	Swinson's Hawk	Ringtail
Flathead Catfish	Ferruginous Hawk	Longtail Weasel
White Bass	Kestrel	Striped Skunk
Green Sunfish	Scaled Quail	Hognose Skunk
Warmouth	Mourning Dove	Coyote
Bluegill	Roadrunner	Gray Fox
Longear Sunfish	Barn Owl	Bobcat
Largemouth Black Bass	Screesh Owl	Plains Pocket Mouse
White Crappie	Great-horned Owl	Merriman's Pocket Mouse
Black Crappie	Pygmy Owl	Silky Pocket Mouse
Black Buffalohead	Flicker	Desert Pocket Mouse
Spotted Bass	Ladder-backed Woodpecker	Nelson's Pocket Mouse
Southwestern Plains Killifish	Scissor-tailed Flycatcher	Meadow Pocket Mouse
Texas Shiner	Eastern Phoebe	Plains Harvest Mouse
Rainwater Killifish	Say's Phoebe	Cactus Mouse
Pecos Darter	White-breasted Nuthatch	Deer Mouse
Bigscale Logperch	Bewick's Wren	Bush Mouse
Gray Redhorse	Cactus Wren	Rock Mouse
Roundnose Minnow	Canyon Wren	N. Grasshopper Mouse
Mexican Tetra	Rock Wren	White-throated Woodrat
Greenthroat Darter	Winter Wren	Porcupine
Pecos Pupfish	Blue Jay	Desert Cottontail
Silverband Shiner	Crow	Mule Deer
Gray Redhorse	Western Bluebird	
Prosperpine Shiner	Mountain Bluebird	
Blue Sucker	Townsend's Solitaire	
	Curve-billed Thrasher	
	Brown Thrasher	
	Crisal Thrasher	
	Loggerhead Shrike	
	Northern Oriole	
	Pyrrhuloxia	
	Cardinal	
	Indigo Bunting	
	Blue Grosbeak	
	Myrtle Warbler	
	Audubon's Warbler	
	Yellow Warbler	
	House Finch	
	American Goldfinch	
	Lesser Goldfinch	
	Rufous-sided Towhee	
	Brown Towhee	
	Green-tailed Towhee	
	Lark Sparrow	
	Black-throated Sparrow	
	Rufous-crowned Sparrow	
	Dark-eyed Juncos	
	Harris' Sparrow	
	White-crowned Sparrow	
	Golden-crowned Sparrow	
	Lincoln's Sparrow	
<u>REPTILES & AMPHIBIANS</u>		
Eastern Barking Frog		
Coach's Spadefoot Toad		
Western Spadefoot Toad		
Plains Spadefoot Toad		
Great Plains Toad		
Red-spotted Toad		
Texas Banded Gecko		
Crawie Spiny Lizard		
Lesser Earless Lizard		
Greater Earless Lizard		
Leopard Lizard		
Eastern Fence Lizard		
Side-blotched Lizard		
Texas Horned Lizard		
Many-lined Skink		
Six-lined Whiptail		
Texas Spotted Whiptail		
Western Whiptail		
Checkered Whiptail		
Cockwhip		
Bull Snake		
Kingsnake		
Long-nosed Snake		
Plains Black-headed Snake		
Night Snake		
Mossasauga		
Western Diamondback Rattlesnake		
Western Rattlesnake		

MIXED DESERT SHRUB HABITAT

<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Eastern Barking Frog	Cooper's Hawk	Grey Shrew
Coach's Spadefoot Toad	Red-tailed Hawk	Raccoon
Plains Spadefoot Toad	Swinson's Hawk	Ringtail
Western Box Turtle	Harris' Hawk	Longtail Weasel
Lesser Earless Lizard	Ferruginous Hawk	Striped Skunk
Greater Earless Lizard	Kestrel	Hognose Skunk
Leopard Lizard	Marsh Hawk	Coyote
Eastern Fence Lizard	Scaled Quail	Gray Fox
Side-blotched Lizard	Mourning Dove	Bobcat
Texas Horned Lizard	Barn Owl	Plains Pocket Mouse
Round-tailed Lizard	Screesh Owl	Merriman's Pocket Mouse
Great Plains Skink	Great-horned Owl	Silky Pocket Mouse
Many-lined Skink	Roadrunner	Desert Pocket Mouse
Little Striped Whiptail	Lesser Nighthawk	Nelson's Pocket Mouse

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

SPECIES	SPECIES	SPECIES
<u>MIXED DESERT SHRUB HABITAT (Continued)</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Western Whiptail	Flicker	Hispid Pocket Mouse
Checkered Whiptail	Ladder-backed Woodpecker	Plains Harvest Mouse
Texas Blind Snake	Downy Woodpecker	Cactus Mouse
Western Horned Snake	Scissor-tailed Flycatcher	Deer Mouse
Coachwhip	Say's Phoebe	Bush Mouse
Clossy Snake	Eastern Phoebe	Rock Mouse
Bull Snake	W. Kingbird	Northern Grasshopper Mouse
Kingsnake	Ash-throated Flycatcher	White-throated Woodrat
Milksnake	White-necked Raven	Porcupine
Long-nosed Snake	Bevick's Wren	Desert Cottontail
Ground Snake	Cactus Wren	Mule Deer
Plains Black-headed Snake	Loggerhead Shrike	Mexican Ground Squirrel
Western Black-headed Snake	Curve-billed Thrasher	Old Kangaroo Rat
Night Snake	Crisal Thrasher	Black-tailed Jackrabbit
Nassasuga	Brown Thrasher	Pronghorn
Western Diamondback Rattlesnake	Sage Thrasher	
Western Rattlesnake	W. Meadowlark	
	Cedar Waxwing	
	Northern Oriole	
	Western Bluebird	
	Mountain Bluebird	
	Brown Towhee	
	Pyrrhuloxia	
	Green-tailed Towhee	
	Lark Bunting	
	Vesper Sparrow	
	Cassin's Sparrow	
	Black-throated Sparrow	
	White-throated Sparrow	
	Brewer's Sparrow	
	Sage Sparrow	
	Horned Lark	
	Roadrunner	
<u>MESQUITE GRASSLAND</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Couch's Spadefoot Toad	Cooper's Hawk	Striped Skunk
Plains Spadefoot Toad	Red-tailed Hawk	Coyote
Green Toad	Marsh Hawk	Mexican Ground Squirrel
Great Plains Toad	Ferruginous Hawk	Desert Pocket Mouse
Western Box Turtle	Swinson's Hawk	Bobcat
Texas Toad	Kestrel	Nelson's Pocket Mouse
Lesser Earless Lizard	Scalped Quail	Merrill's Kangaroo Rat
Crocker Earless Lizard	Mourning Dove	Plains Harvest Mouse
Leopard Lizard	Barn Owl	Northern Grasshopper Mouse
Desert Spiny Lizard	Screech Owl	Cactus Mouse
Eastern Fence Lizard	Crested Horned Owl	Deer Mouse
Side-blotched Lizard	Flicker	Southern Plains Woodrat
Tree Lizard	Ladder-backed Woodpecker	Desert Cottontail
Texas Horned Lizard	Scissor-tailed Flycatcher	Mule Deer
Short-horned Lizard	Say's Phoebe	
Round-tailed Lizard	Western Kingbird	
Great Plains Skink	Ash-throated Flycatcher	
Many-lined Skink	Crow	
New Mexican Whiptail	White-necked Raven	
Desert Grassland Whiptail	Bevick's Wren	
Six-lined Whiptail	Cactus Wren	
Texas Spotted Whiptail	Brown Thrasher	
Western Whiptail	Curve-billed Thrasher	
Western Blind Snake	Crisal Thrasher	
Texas Blind Snake	Sage Thrasher	
Western Horned Snake	Loggerhead Shrike	
Coachwhip	Western Meadowlark	
Clossy Snake	Western Bluebird	
Bull Snake	Mountain Bluebird	
King Snake	Cedar Waxwing	
Long-nosed Snake	Northern Oriole	
Black-necked Carter Snake	Pyrrhuloxia	
Checkered Carter Snake	Brown Towhee	
Ground Snake	Green-tailed Towhee	
Plains Black-headed Snake	Lark Bunting	
Western Black-headed Snake	Lark Sparrow	
Night Snake	Vesper Sparrow	
Nassasuga	Cassin's Sparrow	
Western Diamondback Rattlesnake	Brewer	
Western Rattlesnake	Black-throated Sparrow	
	White-crowned Sparrow	

Appendix D

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

SPECIES	SPECIES	SPECIES
<u>MESQUITE GRASSLAND (Continued)</u>		
<u>BIRDS</u>		
	Roadrunner	
	Horned Lark	
	Cassin's Sparrow	
	Black-throated Sparrow	
<u>CREOSOTE HABITAT</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Eastern Barking Frog	Red-tailed Hawk	Striped Skunk
Couch's Spadefoot Toad	Ferruginous Hawk	Coyote
Great Plains Toad	Swainson's Hawk	Bobcat
Red-spotted Toad	Kestrel	Mexican Ground Squirrel
Texas Banded Gecko	Harris' Hawk	Desert Pocket Mouse
Lesser Earless Lizard	Scaled Quail	Nelson's Pocket Mouse
Greater Earless Lizard	Crisall Thrasher	Merriam's Kangaroo Rat
Leopard Lizard	Western Meadowlark	Plains Harvest Mouse
Crevice Spiny Lizard	Grasshopper Sparrow	Northern Grasshopper Mouse
Eastern Fence Lizard	Lark Bunting	Cactus Mouse
Side-blotched Lizard	Lark Sparrow	Deer Mouse
Round-tailed Horned Lizard	Vesper Sparrow	Southern Plains Woodrat
Many-lined Skink	Cassin's Sparrow	Desert Cottontail
Six-lined Whiptail	Black-throated Sparrow	Mule Deer
Texas Spotted Whiptail	Horned Lark (shortgrass)	
Western Whiptail	Roadrunner	
Texas Blind Snake		
Coachwhip		
Glossy Snake		
Bull Snake		
Long-nosed Snake		
Ground Snake		
Western Black-headed Snake		
Western Diamondback Rattlesnake		
<u>SHORTGRASS HABITAT</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Couch's Spadefoot Toad	Mountain Plover	Badger
Western Spadefoot Toad	American Golden Plover	Striped Skunk
Plains Spadefoot Toad	Long-billed Curlew	Coyote
Great Plains Toad	Upland Plover	Swift Fox
Texas Toad	Mississippi Kite	Kit Fox
Western Box Turtle	Marsh Hawk	Thirteen-lined Ground Squirrel
Eastern Fence Lizard	Rough-legged Hawk	Merriam's Pocket Mouse
Short-horned Lizard	Red-tailed Hawk	Silky Pocket Mouse
Many-lined Skink	Ferruginous Hawk	Plains Harvest Mouse
Little Striped Whiptail	Swainson's Hawk	Deer Mouse
Six-lined Whiptail	Golden Eagle	Northern Grasshopper Mouse
Texas Blind Snake	Prairie Falcon	Black-tailed Jackrabbit
Glossy Snake	Kestrel	Pronghorn Antelope
King Snake	Peregrine Falcon	
Long-nosed Snake	Scaled Quail	
Plains Black-headed Snake	Mourning Dove	
Massasauga	Roadrunner	
Western Diamondbacked Rattlesnake	Burrowing Owl	
Western Rattlesnake	Short-eared Owl	
	Common Night Hawk	
	Lesser Night Hawk	
	Scissor-tailed Flycatcher	
	Horned Lark	
	White-necked Raven	
	Sprague's Pipit	
	Western Meadowlark	
	Lark Bunting	
	Grasshopper Sparrow	
	Baird's Sparrow	
	Lark Sparrow	
	Vesper Sparrow	
	Cassin's Sparrow	
	McGowan's Longspur	
	Chestnut-collared Longspur	
	Dickcissel	

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

SPECIES	SPECIES	SPECIES
<u>SHINNEY OAK/DUNE HABITAT</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Side-blotched Lizard	Vareh Hawk	Badger
Lesser Earless Lizard	Rough-legged Hawk	Striped Skunk
Leopard Lizard	Red-tailed Hawk	Coyote
Eastern Fence Lizard	Ferruginous Hawk	Plains Pocket Mouse
Round-tailed Horned Lizard	Swinson's Hawk	Desert Pocket Mouse
Sandune Sagebrush Lizard	Harris' Hawk	Merriam's Kangaroo Rat
Six-lined Whiptail	Kestrel	Deer Mouse
Western Whiptail	Scaled Quail	Northern Grasshopper Mouse
Texas Blind Snake	Mourning Dove	Blacktail Jackrabbit
Western Hognosed Snake	Roadrunner	Desert Cottontail
Bull Snake	Burrowing Owl	Mule Deer
Messasauga	White-necked Raven	Spotted Ground Squirrel
Western Diamondbacked Rattlesnake	Cactus Wren	Plains Pocket Gopher
Western Rattlesnake	Loggerhead Shrike	Silky Pocket Mouse
	W. Meadowlark	Ord's Kangaroo Rat
	Pyrrhuloxia	
	House Finch	
	Grasshopper Sparrow	
	Baird's Sparrow	
	Lark Sparrow	
	Vesper Sparrow	
	Cassin's Sparrow	
	Sage Sparrow	
	Brewer's Sparrow	
<u>BROADLEAF TREE HABITAT (Upland)</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Coach's Spadefoot Toad	Cooper's Hawk	Raccoon
Western Spadefoot Toad	Red-tailed Hawk	Longtail Weasel
Plains Spadefoot Toad	Swinson's Hawk	Striped Skunk
Great Plains Toad	Ferruginous Hawk	Hognose Skunk
Red-spotted Toad	Kestrel	Coyote
Leopard Lizard	Scaled Quail	Gray Fox
Eastern Fence Lizard	Mourning Dove	Bobcat
Side-blotched Lizard	Roadrunner	Plains Pocket Mouse
Couchwhip	Sarna Owl	Merriam's Pocket Mouse
Bull Snake	Screech Owl	Nelson's Pocket Mouse
Kingsnake	Great-horned Owl	Hispid Pocket Mouse
Long-nosed Snake	Long-eared Owl	Plains Harvest Mouse
Plains Black-headed Snake	Pygmy Owl	Deer Mouse
Night Snake	Flicker	Bush Mouse
Messasauga	Red-headed Woodpecker	Northern Grasshopper Mouse
Western Diamondback Rattlesnake	Ladder-backed Woodpecker	White-throated Woodrat
Black-tailed Rattlesnake	Scissor-tailed Flycatcher	Porcupine
Western Rattlesnake	Eastern Phoebe	Desert Cottontail
	Say's Phoebe	Wile Deer
	White-breasted Nuthatch	
	Bewick's Wren	
	Cactus Wren	
	Winter Wren	
	Blue Jay	
	Crow	
	Western Bluebird	
	Mountain Bluebird	
	Townsend's Solitaire	
	Curve-billed Thrasher	
	Brown Thrasher	
	Loggerhead Shrike	
	Northern Oriole	
	Pyrrhuloxia	
	Cardinal	
	Indigo Bunting	
	Blue Grosbeak	
	Myrtle Warbler	
	Audubon's Warbler	
	Yellow Warbler	
	Verdin	
	House Finch	
	American Goldfinch	
	Lesser Goldfinch	
	Rufous-billed Towhee	
	Brown Towhee	
	Green-tailed Towhee	
	Lark Sparrow	
	Black-throated Sparrow	
	Rufous-crowned Sparrow	
	Dark-eyed Junco	
	Harris' Sparrow	
	White-crowned Sparrow	
	Golden-crowned Sparrow	
	Lincoln's Sparrow	

MAJOR HABITAT TYPES AND RELATED ANIMAL SPECIES

SPECIES	SPECIES	SPECIES
<u>PINYON-JUNIPER HABITAT</u>		
<u>REPTILES & AMPHIBIANS</u>	<u>BIRDS</u>	<u>MAMMALS</u>
Collared Lizard	Mountain Bluebird	Big Brown Bat
Sagebrush Lizard	Western Bluebird	Big Free-tailed Bat
Side-blotched Lizard	Bush-tit	Brazilian Free-tailed Bat
Tree Lizard	Mountain Chickadee	Hoary Bat
Black-necked Carter Snake	Prairie Falcon	Pallid Bat
Western Diamondback Rattlesnake	House Finch	Townsend's Big-eared Bat
Little Striped Whiptail	Common Flicker	Black Bear
Western Whiptail	Ash-throated Flycatcher	Antelope
Crevice Spiny Lizard	Vermilion Flycatcher	Badger
	Blue-gray Gnatcatcher	Beaver
	Black-headed Grosbeak	Bobcat
	Sharp-shinned Hawk	Coyote
	Black-chinned Hummingbird	Mule Deer
	Broad-tailed Hummingbird	White-tailed Deer
	Pinyon Jay	Cray Fox
	Scrub Jay	Kitt Fox
	Cray-headed Junco	Swift Fox
	Cassin's Kingbird	Mountain Lion
	Common Nighthawk	Apache Pocket Mouse
	Clark's Nutcracker	Brush Mouse
	Pygmy Nuthatch	Cactus Mouse
	Scott's Oriole	Deer Mouse
	Great Horned Owl	Northern Grasshopper Mouse
	Long-eared Owl	Pinyon Mouse
	Pygmy Owl	Rock Mouse
	Western Wood Pewee	Silky Pocket Mouse
	Black Phoebe	Western Harvest Mouse
	Band-tailed Pigeon	White-footed Mouse
	Poor-Will	Muskrat
	Scaled Quail	California Myotis
	Roadrunner	Fringed Myotis
	Robin	Long-legged Myotis
	Loggerhead Shrike	Western Pipistrelle
	Pine Siskin	Porcupine
	Townsend's Solitaire	Black-tailed Jackrabbit
	Black-chinned Sparrow	Desert Cottontail Rabbit
	Black-throated Sparrow	Nuttall's Cottontail
	Brewer's Sparrow	Raccoon
	Chipping Sparrow	Banner-tailed Kangaroo Rat
	Lark Sparrow	Hesperian Cotton Rat
	Violet-green Swallow	Mexican Wood Rat
	White-throated Swift	Oryzomys Kangaroo Rat
	Western Tanager	White-throated Wood Rat
	Crissal Thrasher	Barbary Sheep
	Curve-billed Thrasher	Desert Shrew
	Plain Titmouse	Eastern Spotted Skunk
	Brown Towhee	Hog-nosed Skunk
	Green-tailed Towhee	Rock Squirrel
	Rufous-sided Towhee	Long-tailed Weasel
	Wild Turkey	
	Cray Vireo	
	Black-throated Gray Warbler	
	Orange-crowned Warbler	
	Virginia's Warbler	
	Cedar Waxwing	
	Beck's Wren	
	Rock Wren	

Appendix E

THREATENED OR ENDANGERED SPECIES OCCURRING
IN THE ROSWELL DISTRICT

(Source: East Roswell Grazing EIS and NMDG&F Handbook of Endangered Species)

<u>COMMON NAME</u>	<u>CLASSIFICATION</u>	<u>STATUS IN DISTRICT</u>
Nelson's Pocket Mouse	SE/II	Unknown: On periphery of range; 1 specimen collected in state.
Blackfooted Ferret	FE-SE/I	Five prairie dog towns on federal land east of Pecos River, west side of district, not inventoried. Southeastern New Mexico has few large colonies left except on deeded land. Map 7 (Appendix A) identifies potential Black-footed ferret area. Site-specific evaluations will be made in these areas for prairie dog towns.
Olivaceous Cormorant	SE/II	Unknown: Two unverified sightings, one on Bitterlakes National Wildlife Refuge, and one on Pecos River.
Mississippi Kite	SE/II	Summer residents on Pecos River, five unverified reports on Pecos River, no documented nesting pairs.
Bald Eagle	FE-SE/II	Documented winter sightings recorded on map in Roswell District. Less than 10 birds ever recorded in district during winter migration.
Peregrine Falcon	FE-SE/I	No known suitable nesting sites exist on federal land in district. Occasional migrants have been seen.
Aplomado Falcon	SE/I	Unknown: Two unverified sightings in extreme southeastern corner of district.
Least Tern	SE/II	Two verified sightings, one on Bitterlakes National Wildlife Refuge and one on Avalon Reservoir, occasional migrants in Eddy and Lea counties have been sighted.
Redheaded Woodpecker	SE/II	Occasional sightings in summer along Pecos River Valley.
Bell's Vireo	SE/II	Unknown: Summers in lower Pecos Valley, eight unverified sightings in district.
Varied Bunting	SE/II	Small numbers summer in Carlsbad National Park.
Baird's Sparrow	SE/II	Winter migrant, one verified winter sighting near Roswell in 1929.
McCown's Longspur	SE/II	Three verified sightings in district, part of wintering area, however degradation of shortgrass area is a limiting factor.
Texas Slider Turtle	SE/II	Peripheral range in riparian area of southeastern New Mexico, several verified sightings south of Carlsbad on Pecos River.
Sandune Sagebrush Lizard	SE/II	Intensive inventories by BLM and NMDG&F outline distribution areas in district. Found primarily in Mesquero Sands.
Blotched Plain-bellied Water Snake	SE/II	Peripheral range in riparian area of southeastern New Mexico, several verified sightings south of Carlsbad on Pecos River.
Pecos Western Ribbon Snake	SE/II	Peripheral range in riparian area of southeastern New Mexico, frequent sightings along Black River south of Carlsbad.
Trans-Pecos Rat Snake	SE/II	Peripheral range in New Mexico, occurs in Guadalupe mountains but in low numbers.
Mottled Rock Rattlesnake	SE/II	Unknown numbers since this species is at extreme edge of its range.
Eastern Barking Frog	SE/II	
Blanchard's Cricket Frog	SE/II	
Blue Sucker	SE/I	An intensive inventory of the Pecos River riparian area is currently underway. This inventory will identify any threatened or endangered species occurring along the river where most of the riparian habitat exists in the district. There are approximately 43 miles of river front on the Pecos and Black River under federal status.
Gray Raddhorse	SE/I	
Mexican Tetra	SE/II	
Silverband Shiner	SE/I	
Bluntnose Shiner	SE/I	
Silvery Minnow	SE/II	
Greenthroat Darter	SE/II	
Bigscale Logperch	SE/II	
Pecos Gambusia	FE-SE/II	Contracted inventory of this species completed in 1979. Report in Roswell District Office. Blue Springs (private land) has highest population.

FE = Federal Endangered

SE/I = State endangered (Group I) - Species whose prospects of survival or recruitment in the state are in jeopardy.

SE/II = State endangered (Group II) - Species whose prospects of survival or recruitment within the state may become in jeopardy in the foreseeable future.

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REFERENCES

(Note: Although not all references are specifically cited in the text, they are provided for the information and possible further study by the serious reader.)

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GLOSSARY



GLOSSARY

ABANDONMENT: Compliance with the stipulations contained within the agreed surface-use plan and the U. S. Geological Survey's Permit to Drill, e.g.: the drilling site and support roads have been restored to a condition which is acceptable to the surface owner and the well has been plugged and capped. When a well is to be plugged and capped, the well must be sealed as prescribed by the U. S. Geological Survey to prevent contamination of ground water. The access road and pad must also be reclaimed to meet Bureau of Land Management specifications. These stipulations apply to both "dry holes" and to productive wells which cease productivity.

BLM: The Bureau of Land Management, Department of the Interior.

CATHODIC PROTECTION SYSTEMS: Cathodic pipe protection systems which are authorized by a right-of-way grant, are often installed in conjunction with pipelines to prevent corrosion. Essentially, cathodic protection consists of the placement of electrical contacts in the ground to establish an electrical field in the soil around the pipeline. This causes negative ions to migrate away from the metal pipe, helping to prevent corrosion.

CAUSTIC FLUIDS: Any fluid with a high pH value, e.g.: any fluid containing caustic soda.

CLEARING AND BLADING: The use of mechanical equipment, e.g.: bulldozers, to remove vegetation and soil/rocks to permit construction of roads or other facilities.

DISPOSAL WELL: An abandoned or dry well which is used to dispose of saltwater or other brine wastes. These wastes must be pumped into specified geologic formations.

DRY HOLE: Terminology used in the oil and gas industry to describe a well drilled for the purpose of discovering oil and/or gas resource, but which was unproductive.

GEOCHEMICAL: The related chemical and geological properties of a substance.

GEOLOGIC: Of or pertaining to the science or study of geology.

GEOPHYSICAL: Broadly, the physics of the earth. In the more popular and practical sense, the term implies the application of electrical, thermal, magnetic, gravimetric, and seismic methods to the exploration for petroleum, metals, and underground supplies of water.

KNOWN GEOLOGIC STRUCTURE: A term used by the USGS to designate an area in which competitive leasing will take place. Such an area has known reserves of economic minerals.

KNOWN PRODUCING AREA: A known geologic structure which historically has produced petroleum products.

LEASE: A legal agreement to utilize certain resources of the public lands.

MESOZOIC ERA: One of the grand divisions of geologic time including the interval between the Permian and Tertiary periods. It includes the Triassic, Jurassic, and Cretaceous periods. The era was characterized by dinosaurs, marine and flying reptiles, primitive mammals, ganoid fish, ammonites, cycads, ferns, and evergreen trees.

METERING SYSTEM: Gas produced goes through a meter run and/or meter house where the volume, temperature, and pressure are recorded. The meter house is usually a small tin shed. Meters are generally located on the drill pad near the well head and other oil and gas facilities. These facilities are usually approved through a R/W grant.

NATURAL GAS: Gas issuing from the earth's crust through natural openings or bored wells. Also: A combustible mixture of methane and higher hydrocarbons used chiefly as a fuel and raw material.

NMDG&F: New Mexico Department of Game and Fish.

OFF-SITE DRILLING: Drilling at an angle to reach subsurface resources from an adjacent site.

OGALLALA FORMATION (AQUIFER): Waterbearing gravels dating from the Pliocene Epoch (2 to 5 million years ago). These gravels underlie the Llano Estacado area of southeastern New Mexico.

OIL: See petroleum.

OIL CONSERVATION COMMISSION: A New Mexico State organization which administers state regulations for the oil and gas industries.

PERMIT-TO-DRILL: A document issued by the U. S. Geological Survey, with concurrence of the Bureau of Land Management, which authorizes an applicant to drill a specific well on a federal lease and includes the authorized surface-use plan and appropriate stipulations.

PETROLEUM: A naturally occurring, inflammable, complex mixture of hydrocarbons and/or their sulfur, nitrogen, and oxygen derivations which may be removed from the earth in liquid state. It is often accompanied by or contains dissolved natural gas.

PLEISTOCENE EPOCH: The first epoch of the Quaternary period, in general including the time and deposits of the last great glacial epoch. The Pleistocene epoch was preceded by the Pliocene epoch of the Tertiary period. This epoch was marked by repeated glacial advances, worldwide fluctuations of sea level.

PLIOCENE EPOCH: The last epoch of the Tertiary period, and the rocks formed during that time. The Pliocene epoch was preceded by the Miocene epoch and succeeded by the Pleistocene epoch of the Quaternary period.

PUBLIC LANDS: Lands administered by the Bureau of Land Management and owned by the American people in common (the public).

RAPTORS: Birds of prey.

RESERVED MINERAL LANDS: Lands where the mineral rights are federally-owned and surface rights are not.

RESERVOIR PRODUCTION PHASE: In the life of an oil field, when the exploration and development phases of oil field development have been completed, and oil or natural gas resources are being exploited.

RIGHT-OF-WAY (R/W): Permission to transit an area of the public lands or to use a portion of that area for a stipulated purpose.

RIPARIAN HABITAT: A specialized form of wetland restricted to areas along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, also, periodically flooded lake and reservoir shore areas, as well as lakes with stable water levels with characteristic vegetation. This habitat is transitioned between true bottom land wetlands and upland terrestrial habitats and, while associated with water courses may extend inland for considerable distances. Soils of the riparian habitat may not exhibit typical wet soil characteristics of other wetlands. If not, wet soil characteristics will exist close enough to the surface for the water to be used directly by vegetation. Vegetation may range from water-loving hydrophytes (such as pond weeds) through terrestrial forms such as sycamores, cottonwoods, and willows.

RUSTLER FORMATION: Sediments composed of anhydrite, siltstone, sandstone, dolomite, and shales which were deposited in the Delaware evaporite basin during the late Permian Period (225 million years ago). These are a source of relatively poor quality ground water which is suitable for use by livestock in some areas.

SEPARATION SYSTEM: Because gas and oil, oil and water, or even gas, oil and water occur together in the well bore, their separation at the surface is a basic problem. Various types of separation equipment and systems do this and are utilized at well and tank batteries throughout the District. The equipment consists of separators, stabilizers, scrubbers, heater treaters, and precipitators. These systems may either be approved by surface use plan (SUP) or by a right-of-way (R/W) grant.

SLUDGE OIL: Unusable, waste oil.

STANDARD OPERATING PROCEDURES: Procedures which comply with standard rules and regulations of the U. S. Geologic Survey and the Bureau of Land Management.

STIPULATIONS: Standards used to protect federal resources and the natural environment.

STORAGE FACILITIES: Surface storage tanks for oil vary in size from small tanks, usually found at individual wells, to several hundred-barrel capacities depending on total well or lease production and whether the oil is marketed from the well site or from a lease tank battery system. Storage facilities are not only for oil, but also light hydrocarbons, and water associated with oil and gas production.

SURFACE-USE PLAN: The plan of operations submitted by the operator as part of the drilling permit.

TERTIARY PERIOD: The first period of the Cenozoic era, and the rocks formed during that time. The Tertiary period was preceded by the Cretaceous period of the Mesozoic era and succeeded by the Quaternary period. It is composed of the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.

"WALKED-DOWN IN PLACE": A method of disposing of vegetation by simply crushing it in its natural environment by using mechanical equipment.

WATER TREATMENT AND INJECTION FACILITIES: Secondary recovery of oil reservoirs in the district is done primarily by flooding with either saltwater or fresh water although the injection of produced gas is used in some fields. In general, surface facilities consist of a combination of (1) tanks for storage and treatment of water produced with the oil production, (2) a water supply well, (3) aeration and/or sedimentation ponds, (4) chemical treater, (5) a filtering system, (9) an injection well, and (10) pipelines and valves. Pumps (normally housed in metal buildings) are used to inject water under pressure into the oil producing formation to force oil to flow to the top of the formation. Most of the surface production facilities mentioned are located on the oil and gas lease, however, many facilities must be authorized through rights-of-way.

WELL HEAD: Well heads consist of several different type combinations of equipment which may include a casing head, casing hanger, intermediate casing head, tubing head, tubing hanger, tubing adapter, valves, trees and crosses, chokes and flow controls, and tree top. The head is commonly referred to as a "Christmas Tree" by oil and gas field personnel.

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